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SCIENTIFIC AMERICAN

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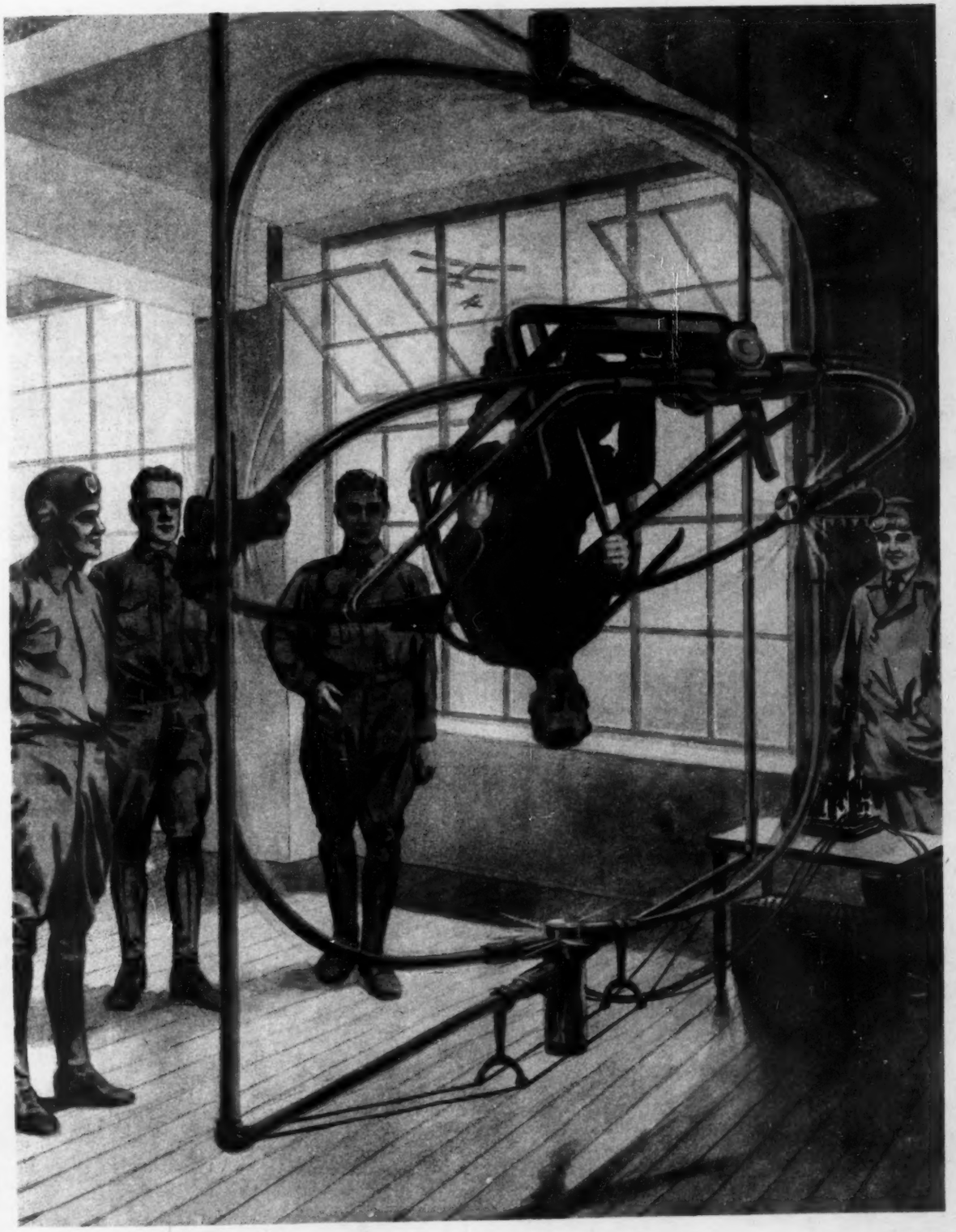

TRAINING IN THE ART OF FLYING WITHOUT LEAVING THE GROUND [See page 547]

Vol. CXX. No. 21
May 24, 1919

Published Weekly by
Scientific American Publishing Co.
Munn & Co., New York, N. Y.

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You want dependable equipment, of course; make "Dodge" your shop standard.

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We take full responsibility for the economical operation of any Dodge, Oneida or Keystone product in any branch of industrial service; that's the big reason for making Dodge your shop standard; look to us for advice and then expect continuous production as a result.

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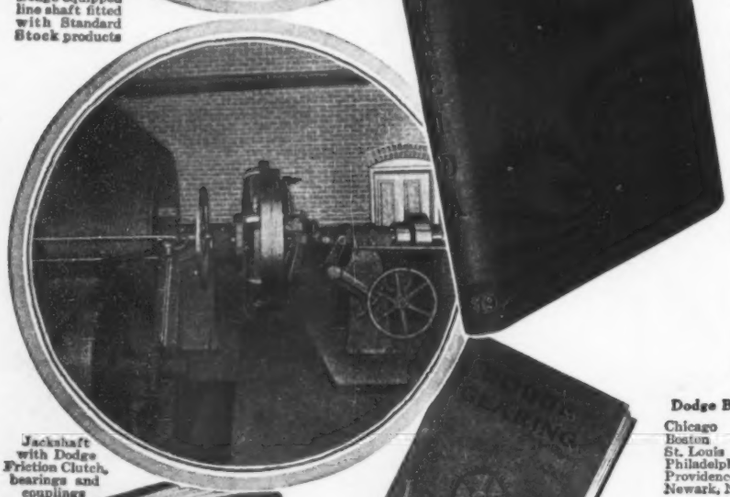
Whenever possible order Dodge Products from your dealer; he is competent to advise you and we prefer to receive all orders for stock products through him.

We stand back of him just as we guarantee all Dodge products regardless of whether they be marked Dodge, Oneida or Keystone.



Jackshaft with Dodge Friction Clutch, bearings and couplings

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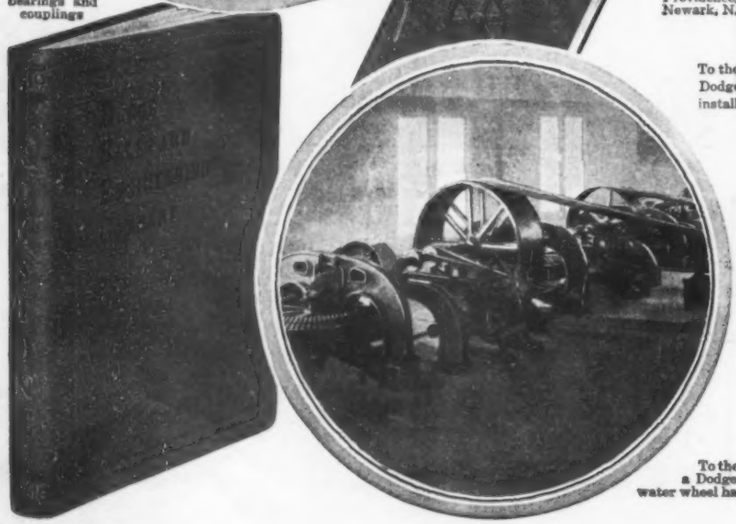
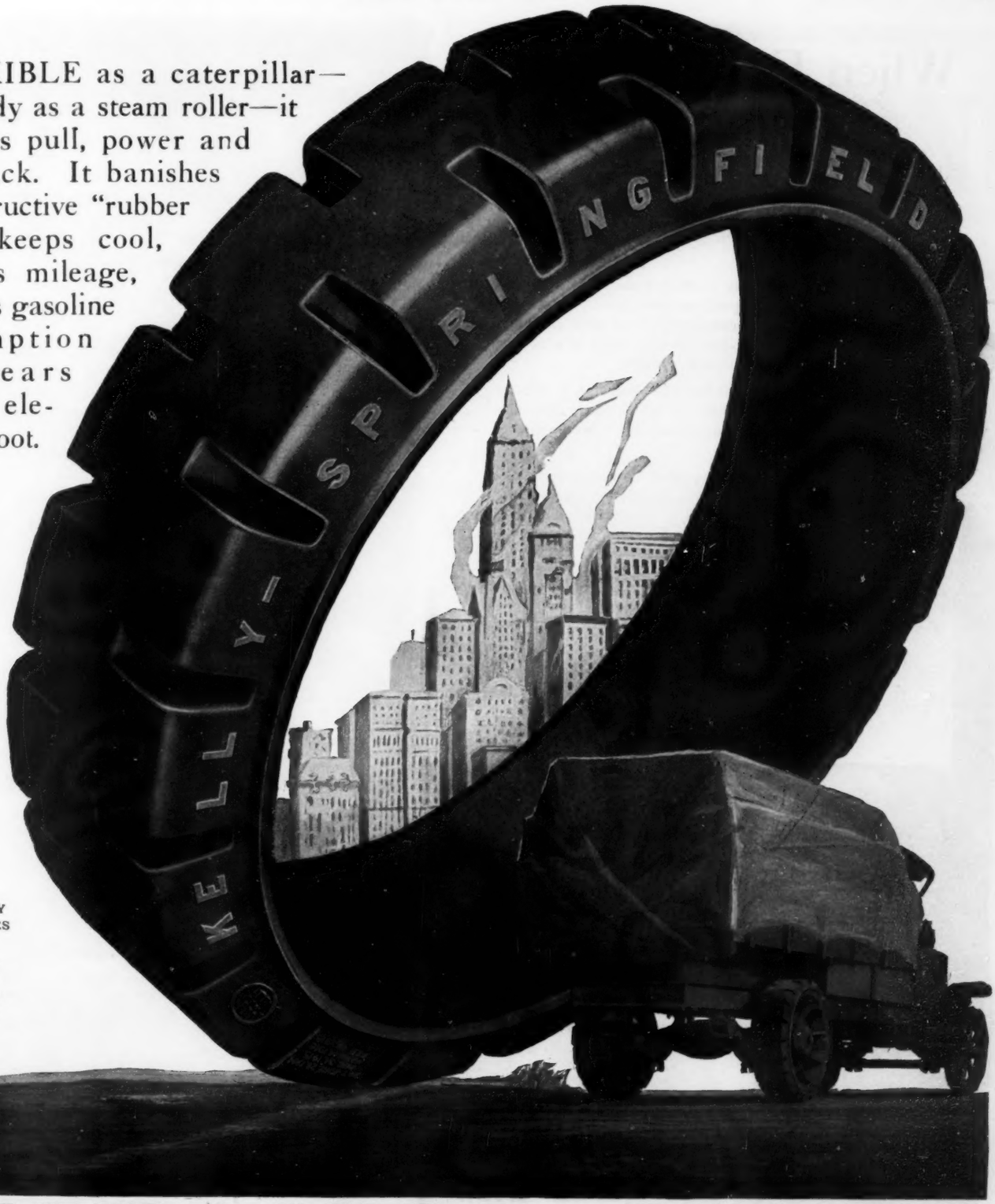
To the right, a typical Dodge rope drive installation.



To the left, a Dodge built water wheel harness

We are sending this monthly magazine to 32,000 executives and engineers. —Shall we send it to you for 6 months without cost?

FLEXIBLE as a caterpillar—sturdy as a steam roller—it combines pull, power and come back. It banishes the destructive "rubber wave," keeps cool, increases mileage, decreases gasoline consumption and wears like an elephant's foot.



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When Fate and Fire Throw Dice

A TINY SPARK, a sputtering flame—then a raging furnace of heat, fire and destruction; another town or perhaps a whole city desolated, gutted; wiped completely off the earth; victims of the red scourge!

When will it stop?

By some weird schedule, yet with remarkable accuracy, fate and fire pick their path—and it's usually across the inflammable roofs of a community. And what is to halt the progress of roof-to-roof fires unless it is a roofing which *resists* fire and stops its spread?

Such roofings are of Johns-Manville Asbestos, a mineral which satisfies every roofing requirement as to durability and economy, and, in addition, adds the supreme quality of fire-protection.

When the greatness of Johns-Manville contribution to a "fire-safe America" is fully realized, there will be a better understanding of ASBESTOS, a clearer appreciation of its uses—*and, most important of all, there will be fewer fires.*

Johns-Manville Asbestos Roofings are made in many forms so that now every building can have the protection it needs. Johns-Manville Asbestos and Colorblende Shingles for homes. Johns-Manville Brooks and Flextone Ready Asbestos Roofing, for sloping roofs or large permanent buildings. Johns-Manville Built-Up Roofing for all flat surfaces, and Johns-Manville Corrugated Asbestos Roofings for skeleton frame buildings.

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SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXX.
NUMBER 21

NEW YORK, MAY 24, 1919

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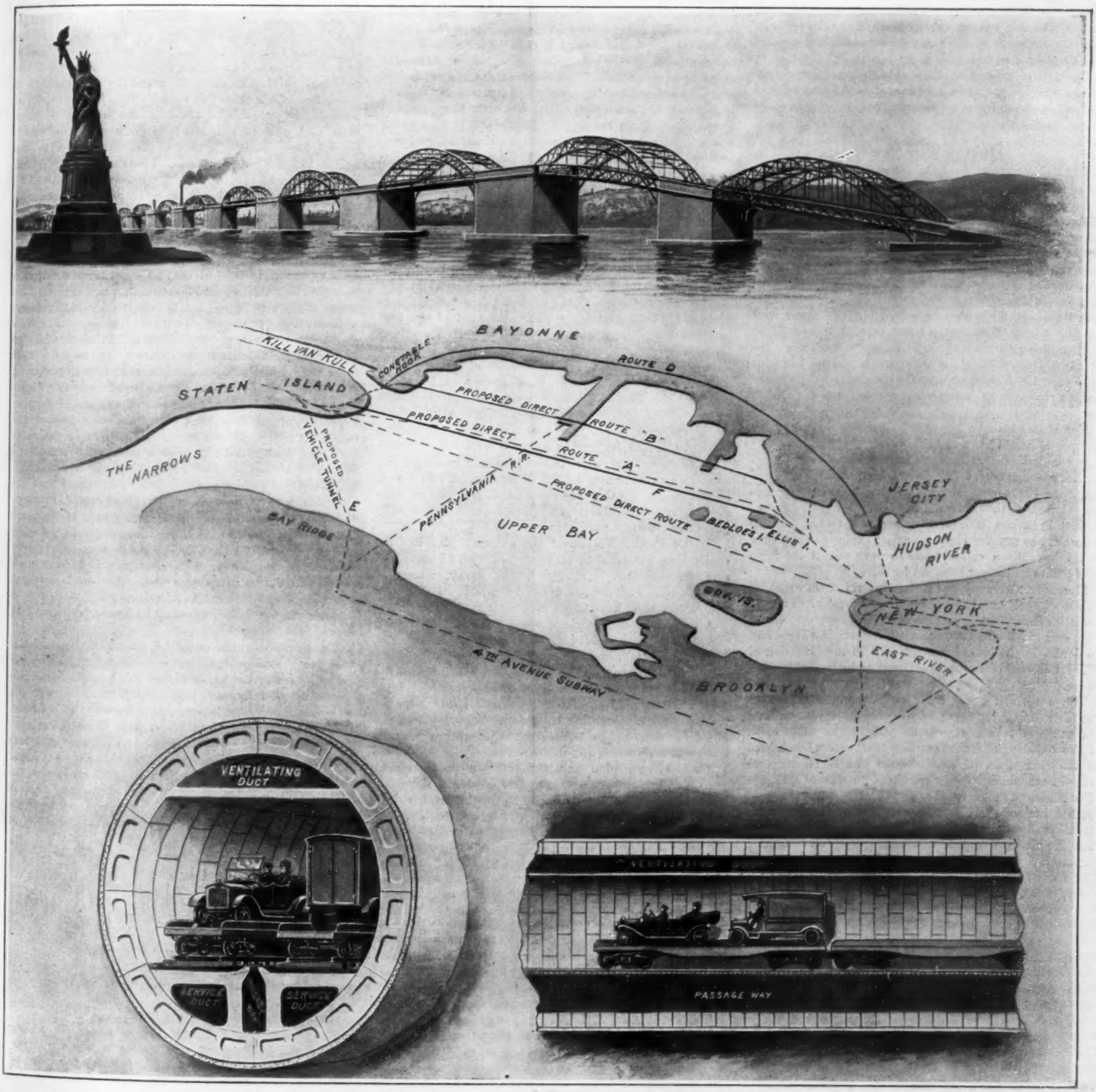

In the map, tunnels are shown by broken lines and bridges by full lines. Above is the proposed bridge running from Ellis Island to Staten Island and below the proposed vehicle tunnel to Bay Ridge, showing how vehicles would be transported on flat cars.

Various plans for connecting Staten Island with Manhattan. **(See page 545)**

SCIENTIFIC AMERICAN

Published by Scientific American Publishing Co.
Founded 1845

New York, Saturday, May 24, 1919

Munn & Co., 233 Broadway, New York

Charles Allen Munn, President; Orson D. Munn, Treasurer
Allan C. Hoffman, Secretary; all at 233 Broadway

Entered at the Post Office of New York, N. Y., as Second Class Matter
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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

From War to Work

THE greatest deed of kindness ever done to Germany was the stroke of the Allied pen which reduced her army from a potential military force of 10,000,000 to a permanent police force of 100,000.

For thereby have the German people been turned from war to work. They cannot any longer war; but they can work—they must work—and they will. Patriotism and common sense point that way. Your German is nothing if he is not practical; and, whatever may be wrong with his psychology, he can never shut his eyes to the fact that, at the present moment, the obvious thing for him to do is to go to work; set the wheels of his wonderfully efficient industrial machine in motion; and apply himself with dogged determination to the task of getting his country back upon its feet.

Nor is the task so hopeless as Scheidemann and his coadjutors would have us believe.

In the first place, the terms imposed on Germany are far less onerous than a Germany triumphant would have laid upon the Allies; and no one knows this so well as the Germans themselves. For despite their railing against President Wilson, they are well aware that his influence has won for them an easier expiation than they would have been called upon to work out, if the fourteen points had never been set forth.

Moreover, Germany will go to work rid of the crushing weight of her naval and military burdens. Pre-war statistics show that in money alone this represented the huge sum of $400,000,000 annually—which was exceeded, no doubt, in the loss of revenue, due to the diversion of many millions of her people from industry and commerce.

The return of these hosts of German workmen to the factory and the farm, and to transportation on land and sea, will represent a great addition to the wealth of the country; and the resulting revenues, when added to the clear gain of $400,000,000 due to military retrenchment, should easily represent an annual addition of a billion dollars to the assets of the nation. A further increment of wealth will be due to the reconstruction of her vast armament works for the production of articles of trade and commerce.

Germany will go to work, not merely in the material but, also in the moral and ethical world, where, if anything, she has even more serious leeway to make up. She must win her way back to the confidence of the world that she has so greatly betrayed—for it is inconceivable that she will be content to remain forever a Pariah among the peoples of the earth. And there is no surer road by which to return than that broad international highway which is builded of honor, consideration and mutual good faith.

Some few men of note there are in Germany who clearly realize these truths in all their naked simplicity; and to their honor be it said that, in the midst of all the present rhodomontade over the so-called brutality and betrayal of the peace treaties, they have not hesitated to say to the German people "Be quiet, and go to work."

Crop Growing on Contract

CROP production on contract as American farmers will grow wheat the coming season, the United States government guaranteeing a stated price for the entire crop, is new in agriculture, a war-time emergency measure which will not likely be repeated, but crop growing on private contract was in practice before the war, has been widely extended, and will undoubtedly become of great permanent importance. It is not generally known that the contract system is followed exclusively in the beet sugar industry, the scope of which in the American West vastly increased during the war; that factories canning sweet corn, peas, tomatoes and other vegetables invariably sign contracts with growers, agreeing to take production at a stated price, before the seeding season; that dehydrating plants, vinegar manufactories, pickling concerns and jam manufacturers, find the system an indispensable part of their business. The vast seed-growing industry of the United States is operated very largely now on a contract basis. Extension of the contract idea everywhere makes for stability in agriculture. It eliminates risk and speculation, and is beneficial alike to grower and buyer. No farmers in America are more prosperous as a class than contract growers, who know before the season starts to whom they will sell their crop, what price they will obtain, and who in consequence can devote their whole energies to improvement of cultural methods and attainment of maximum production.

When a crop is grown on contract, the farmer nearly always can make convenient arrangements for handling it, either through loans direct of the contracting company or of a local bank in which the company is a heavy depositor. Contracting companies, like the beet sugar manufacturers, generally have field men expert in production of their special crop who give free assistance to farmers. The companies supply pure seed of the best varieties and strains at a moderate price. They help the farmer in every way possible to success, even finding labor for him. It is a regular practice of western beet-sugar companies to recruit great groups of beet-field help, for thinning and other growing season work, and in the fall for pulling and topping. These workers also are on contract, in this case with the farmer, performing work at so much per acre or so much per ton.

In January this year Colorado sugar beet growers were signing contracts for the 1919 crop at $10 a ton. In thousands of other American localities growers were signing crop contracts at prices which practically guaranteed them a profitable year.

In the Pacific Northwest the contract plan has recently been extended to orchard care. At so much per acre, management syndicates prune, spray, intercrop, harvest, pack and ship the fruit of orchards. Some such contractors have several hundred acres under their care.

A large part of America's whole milk is sold to city distributors on price contracts monthly or longer. In New England the entire bargaining process is between the city distributors and an association which represents thousands of producers. The Fraser Valley Milk Producers Association of the Northwest is not large by membership, representing only about 900 dairymen, yet it sells over a million dollars' worth of milk a year on contracts between it and distributors.

The contract plan substitutes for a problematical market a certain one. If the farmer thinks the price offered is too low, he need not grow the crop, a fact which in itself practically guarantees a profitable quotation. There are obvious limits to the development of the contract crop idea, but within its own sphere it is fine business for all interests concerned.

The Fighting Ships of the World

THERE was evidence during the past four or five years that many a naval enthusiast was trying to keep a close record of the gains and losses of the nations that were engaged in the Great War—a thankless task, as most of them sooner or later discovered. Such facts or supposed facts as were disclosed came chiefly through the ordinary channels of news, for government censorship concealed or disclosed losses according as it saw fit.

With the signing of the armistice, however, all the governments showed a welcome and much-appreciated liberality in the matter of naval information, with the result that the various naval annuals that are making their belated appearance are able to place before the public a remarkably complete statement of the present standing of the navies of the world. Conspicuous among these publications is Jane's "Fighting Ships" for the year 1918, the appearance of which marks the twenty-first year of issue of this widely-known work. The delay in its appearance was due to the fact that one-half of the book, comprising the British, German, United States, Japanese, and French sections, was not released until the censorship of naval information came to an end. The delay was not without its advantages, since it enabled the publishers to include a Supplement describing the new British warship types built during the War.

In its general makeup and the completeness of its information, this volume is generally similar to those with which we were familiar before, and during the early years of, the Great War. It comprises nearly 500 pages of information, and with the exception of the British and United States navies, there are the usual half-tone engravings followed by line cuts showing the profile and deck plans and the armor and gun distribution of the principal ships. Twenty-one pages are devoted to a tabulation of the ships lost in the war, which is rendered particularly valuable to the historian by the insertion after each ship of the date and circumstances attending its loss. It is a gruesome list, starting with the British loss of 3 battle-cruisers, 12 battleships, 12 armored cruisers, 9 protected and light cruisers, 5 monitors, 61 destroyers, 5 torpedo boats, 26 or more submarines, and 37 merchant auxiliaries. Compared with this, the fleet of the United States comes off very lightly with a loss of one armored cruiser, 2 destroyers, a submarine, and 5 or 6 auxiliaries. France lost 4 battleships, 4 armored cruisers, a protected cruiser, 9 destroyers, 6 torpedo boats, 13 submarines, and 9 mercantile auxiliaries. The losses of Italy include 4 battleships, an armored cruiser, 4 destroyers, 3 torpedo boats, 4 submarines and 2 mercantile auxiliaries. Japan lost a battleship, a battle-cruiser, 2 light cruisers, a destroyer, a torpedo boat and a submarine, with some vessels of smaller importance.

At the time of going to press, the editors of "Fighting Ships" were in some doubt as to the extent of German losses in capital ships, and the probability is that the appearance of Jellicoe's work and access to later information will provide us with a more exact statement in the 1919 issue. The battleship loss is set down tentatively as 3 ships and it is definitely stated that the Germans lost one battle-cruiser, 6 armored cruisers, 18 light cruisers, 45 or more destroyers, 14 or more torpedo boats and over 150 submarines. Admiral Sims has recently stated that the total German loss in submarines was well over 200. Forty-two or more mercantile auxiliaries were also lost. Austria is credited with the loss of 3 or 4 battleships, 3 light cruisers, 2 monitors, a dozen destroyers and torpedo boats, and 15 submarines.

The inclusion of the naval conditions of the armistice both for Germany and Austria-Hungary will be appreciated by historians who will find this book to be a valuable work of reference, particularly as it includes the terms imposed on the lesser powers, Turkey and Bulgaria.

Although the Supplement on new British war construction contains no photographs or line cuts, the text is complete as far as it was available at the time of issue. It is a formidable list, including the great cruiser battleship "Hood"; the so-called "hush" ships; and various light cruisers, monitors, destroyers, and submarines, most of which have been illustrated and described in the SCIENTIFIC AMERICAN.

The public as a rule do not appreciate how greatly the strength of a navy is related to the number and excellence of its harbors, naval bases, dry docks, and other shore facilities. One of the best features of this publication is the excellent charts of the leading harbors, navy yards, etc., with their facilities, which precedes the chapter devoted to each naval power. Jane's "Fighting Ships" in common with all publications of its class was hard hit by the war, and we are glad to see the promise in this first issue after the war that it will continue to maintain its well-earned reputation.

The present editor, Mr. Maurice Prendergast, assures us that the 1919 edition will appear at a much earlier date than this issue and that it will do full justice, by text and illustrations to the British, United States and Allied navies.

Electricity

Electric Arc-Welding Nomenclature.—In order to standardize the various types of electric weld employed in shipbuilding work, the Welding Committee of the U. S. Emergency Fleet Corporation have prepared a chart describing these by means of symbols. For instance, a strap weld is denoted by a small circle, a butt weld by an equilateral triangle, and a fillet by a letter inverted. Similarly, the design of the weld, whether single or double vee or bevel, its position, the kind of weld—tack weld, strength weld, etc.—and the finish of the weld, are all indicated by symbols. The adoption of this code has been indispensable, and enables all the requisite instructions to be quickly marked on the working drawing in a very small space as compared with a written specification.

American-Built Lafayette Wireless Station in France.—The sale of the great Lafayette wireless station at Bordeaux to the French government at a price of approximately $4,000,000, and many hitherto unpublished facts of American naval activities in the war, were announced recently by Assistant Secretary Roosevelt. "The great Lafayette radio station near Bordeaux was intended to insure communication between Washington and the Army and Navy, in case the cable system was put out of commission or interfered with by German submarines," Mr. Roosevelt said. "It has eight towers and could communicate with the United States day or night. It was built by the Navy. I arranged with the French government that we shall complete the station, which is two-thirds finished, and they will than take it over at what it costs us, about 22,000,000 francs."

Trees as Aerials for Wireless.—It is difficult indeed to find something really new in radio communication. Things which are hailed as new in the daily press are more often apt to prove merely developments or improvements along well-known lines, and it is in that class that the recent tree aerial tests at Washington, D. C., fall. As far back as 1907, experiments were carried out in which trees were employed as aerials. In the recent tests messages were received over quite a distance by means of tree aerials. It was also pointed out that messages could be transmitted through the agency of tree aerials over short distances. However, in view of the remarkably sensitive receiving apparatus available today, the use of tree aerials is no more remarkable than it was back in 1907, with the relatively crude instruments of that time.

Electric Heaters in Sweden.—The use of electricity for heating purposes is comparatively new, but since the enormous water power in Sweden and Norway has been increasingly utilized, and especially because of the acute shortage of fuel during the war, electric heating has become more and more extensive in Scandinavia. Back in 1915 a company was organized for the purpose of manufacturing electric heating apparatus. In the beginning this factory employed 40 men, but at the end of 1917 the number was increased to 500. Extensions are now being made which are expected to be finished in the fall of 1919, when the number of employees will be about 1,200. The factory makes all kinds of heating apparatus for cooking, ironing, and so on, and all kinds of lamps and heating materials. All of which is by way of showing how certain countries are developing their water power to the utmost extent.

A New Type of Selective Aerial.—An ordinary aerial responds best to incoming signals whose frequency coincides with that of the aerial, but it will also oscillate at its own period when excited by electromagnetic waves having a widely different period, and this latter effect is important when such waves emanate from powerful transmitters near the aerial. R. A. Weagant has found that by placing a series of coils in the antenna from the earth to the free end, the aerial takes on a characteristic which permits it to respond only to radio signals of the frequency to which the complete antenna system is tuned. By adopting this construction it has been found possible to eliminate the interference of transmitting stations operating on short wave-lengths in proximity to the large receiving aerial employed by the Marconi organization in trans-oceanic communication. It was also found possible, with this construction, at the Marconi laboratory at Aldene, N. J., to receive signals from Nauen with the ordinary laboratory aerial while the operation of testing transmitters in the factory building was going on.

Astronomy

Jerome Coggia, whose name is attached to the great comet of 1874, recently died in France, where he served as assistant at Marseilles Observatory from 1866 to 1917. He was the discoverer of seven comets besides the one that bears his name; also of five minor planets.

The Adolfo Stahl Lectures in Astronomy, delivered in San Francisco in the seasons 1916-17 and 1917-18, under the auspices of the Astronomical Society of the Pacific, are to be published in book form, with the aid of funds furnished by Mr. Stahl. The lectures have been revised and brought up to date so as to constitute a valuable digest of information on various astronomical topics down to the close of 1918.

Astronomical Lantern Slides.—A valuable set of astronomical lantern slides which belonged to the late Sir Robert Ball has recently been acquired by the British Astronomical Association. The association has also lately added to its collection sets of slides which belonged to Rev. Edmund Ledger and J. A. Hardcastle. These and other slides belonging to the Lantern Slide Loan Department of the association are housed at the Royal Observatory, Greenwich, and are available for hire by members.

Meteorites in Tertiary Strata.—It is suggested by *Nature* that the notable absence of recognizable meteorites from the series of stratified rocks is possibly due to the rapid disintegration of the meteoric substance, which even in museum collections shows a deplorable tendency to decay. It is stated, however, that the British Museum has recently received a slice of meteoric iron which was found at a place near Dawson, in the Klondike, and which, like another meteoric iron previously found in the same neighborhood, was lying deep in certain gravels believed to be of Pliocene age, or older. Canadian geologists believe that both objects formed part of a single meteor shower which took place in Tertiary times.

Beta Cygni Probably Triple.—The beautiful double star Beta Cygni (Albireo) is well known to the users of telescopes. The fainter component is 35 seconds from the primary, and the relative positions of the two objects have not changed appreciably during the century or more covered by position observations. Recent spectroscopic measurements of the brighter star made at Lick Observatory have confirmed the suspicion previously entertained that its radial velocity varies. As the star has a composite spectrum, corresponding in general to that of yellow stars such as Arcturus or Alpha Cassiopeiæ, but also showing the strong hydrogen lines and the weak and narrow K calcium line characteristic of many blue stars, such as Sirius, the variation in its radial velocity is most plausibly explained by regarding it as a spectroscopic binary. In other words, Beta Cygni is probably a triple star. As the colors of the two stars seen in the telescope are yellow and blue, finely contrasted, it is interesting to learn that the spectroscopic pair also consists of a yellow star and a blue star.

A Complaint from the Southern Hemisphere.—Mr. C. H. Tripp, of Timaru, N. Z., writes to the British Astronomical Association to complain of the common practice of ignoring the southern hemisphere in certain statements commonly found in books on astronomy. For example, we constantly find views of the sun, moon, planets and constellations, labeled "as seen with an inverting telescope." It would be proper to add the words "in the northern hemisphere," since in the southern all these objects are seen upside down, as compared with the northern view of them, and the inverting telescope restores them to the positions in which they are seen with the naked eye in northerly latitudes. Another common error, says Mr. Tripp, is to describe the sun as always seeming to move in the direction of the hands of a watch. In the southern hemisphere the sun's apparent movement is just the opposite. He states that even experienced instrument-makers become confused on such subjects and send to southern astronomers equatorial mountings for telescopes with the right ascension circles reading the wrong way round. In one case a price-list of turbines contained particular instructions to purchasers to state whether the turbines were required to turn the way of the sun or against the sun. This came from a firm in the northern hemisphere, and might easily lead to expensive mistakes if the turbines were to be used south of the equator.

Automobile

Closed Bodies Popular.—There has been a marked tendency in the past few years toward the various enclosed types of motor cars for all the year round use, especially favored models being the coupe and sedan with easily removable windows for the extreme hot weather when every breath of air is acceptable. The permanent top types have a big advantage as the covering serves to protect the motorists from the heat of the sun as well as the inclement weather it was originally designed to shield against. The top, when all windows are down, actually creates a better flow of air than is present in the open cars because the air currents are confined and directed against the passengers instead of being dissipated, as in the open car models. The folding top or landaulet types of enclosed bodies are also very popular because one can secure the maximum degree of protection offered by the enclosure and in a very brief period, by dropping the windows and folding the top, one can realize all of the advantages of the open car forms.

Special Tools for Auto Repair Men.—The production of enormous quantities of popular priced automobiles has created a new industry and that is the production of special tools, jigs and fixtures for making repair work easier on these cars. In the early days, the repairman was forced to make his own special fixtures and it was not often a profitable thing to do because it was seldom that enough cars of one make would be received for repairs to warrant the expenditure of money and labor. Now conditions are changed and so many cars of certain popular makes are used in even small communities that the service station is justified in stocking certain fixtures. Even the smallest shop includes valve head and seat reamers, valve grinding tools, bushing extractors, gear pullers and other devices of that kind. Shops of greater pretensions can now obtain engine supporting stands, special cylinder boring tools, rebabbitting jigs, piston chucks, connecting rods, aligning fixtures and numerous others that reduce labor and repair costs and yet that can be procured at much lower cost than they could make the devices in their own shops, because they are the product of specializing manufacturers. The desirability of having work done in any shop where time saving fixtures are used is apparent, as the intelligent motorist realizes that he is not paying for wasted time when special tools are employed on his work. It may take a certain class of repairman several hours to drive off a gear from a shaft, often with serious consequences to both members. The real mechanic uses a special gear puller that accomplishes the work in one quarter the time and without danger.

Leading Maker Adopts Dual Valves.—For some time past considerable attention has been paid to refinements of engine design that would increase power without calling for augmented piston displacement. One method of doing this that has been used for a number of years in racing automobile and aircraft engines has been the use of dual valves, *i. e.*, two exhaust and two intake valves per cylinder instead of the conventional half that number. In order to give superior high gear performance, or greater flexibility some makers of four cylinder stock cars have used this feature in their regular product. It has remained for a large company that is an exclusive builder of sixes to adopt this feature on stock models, to meet the public demand for better performance on the direct drive. To satisfy this, in their 48 horse-power model, the company built various types of six-, eight- and 12-cylinder engines and because of these experiments they are now convinced that a six-cylinder engine is the logical type for passenger vehicles. It was discovered that the greater power output of the newly designed engines, especially at the higher speeds, was due almost entirely to the size of the valves employed in proportion to the cylinder displacement volume. In order to obtain as great valve capacity in the six-cylinder 4½ by 5¼ inch engine with which its 48 horse-power model has been equipped as found in the high speed forms they developed, it would have been necessary to use 3-inch valves with a ⅜-inch lift. With a greater lift, of course, a smaller diameter valve would have sufficed, but it was figured that ⅜-inch was the maximum lift which would permit of reasonably quiet valve operation, so the logical solution was to use a larger number of small valves. Under the old system of nomenclature the engine would have been referred to as a 24-valve design.

Cleaning Up After the Submarine War

Bringing the Ships of Our Merchant Marine Back to Peace-Time Condition

THE results of the war of German U-boats upon marchant shipping are to be measured not merely by the millions of tons of sunken ships that lie upon the ocean bed, but in a very large tonnage which though torpedoed and more or less badly wrecked, was able to limp home to a repair basin or dry dock, or at least to get near enough to a friendly coast to be beached in shoal water. Indeed, it may safely be said that there was not a merchant ship, big or small, fast or slow, passenger or freight, which did not suffer in some degree from the disabilities imposed by this monstrous outrage.

If anyone wishes to be convinced of this, let him visit any well-found shipping yard that is devoted to general dry dock and repair work, and he will realize what a large amount of time and money have been expended and are still in a large measure necessary, to bring the merchant shipping of the world back to peace-time conditions. You will find such yards heavily congested with shipping chiefly of the cargo and so-called tramp type. The work to be done ranges all the way from the mere routine work of cleaning and painting up to the more serious task of making structural changes involving the cutting away of temporary steel work, and the removing of structures, gear, etc., which was installed as part of the submarine-defense equipment.

Towards the close of the war probably every merchant ship was armed for defense. The armament consisted in most cases of a single gun, mounted astern; but in the large passenger ships included a whole battery of five- or six-inch guns. The ships of our own merchant marine were equipped generally with at least two guns, one mounted on the forecastle deck and the other aft on the quarter deck or poop. Now in order to get good command (height above water) for the guns, these were usually carried upon special steel platforms built of angles, channels and plating which, in order to take the heavy recoil of the guns, had to be built of great strength and stiffness. All of this work has to be cut away and hoisted ashore and the decks and superstructures restored to their peace-time condition.

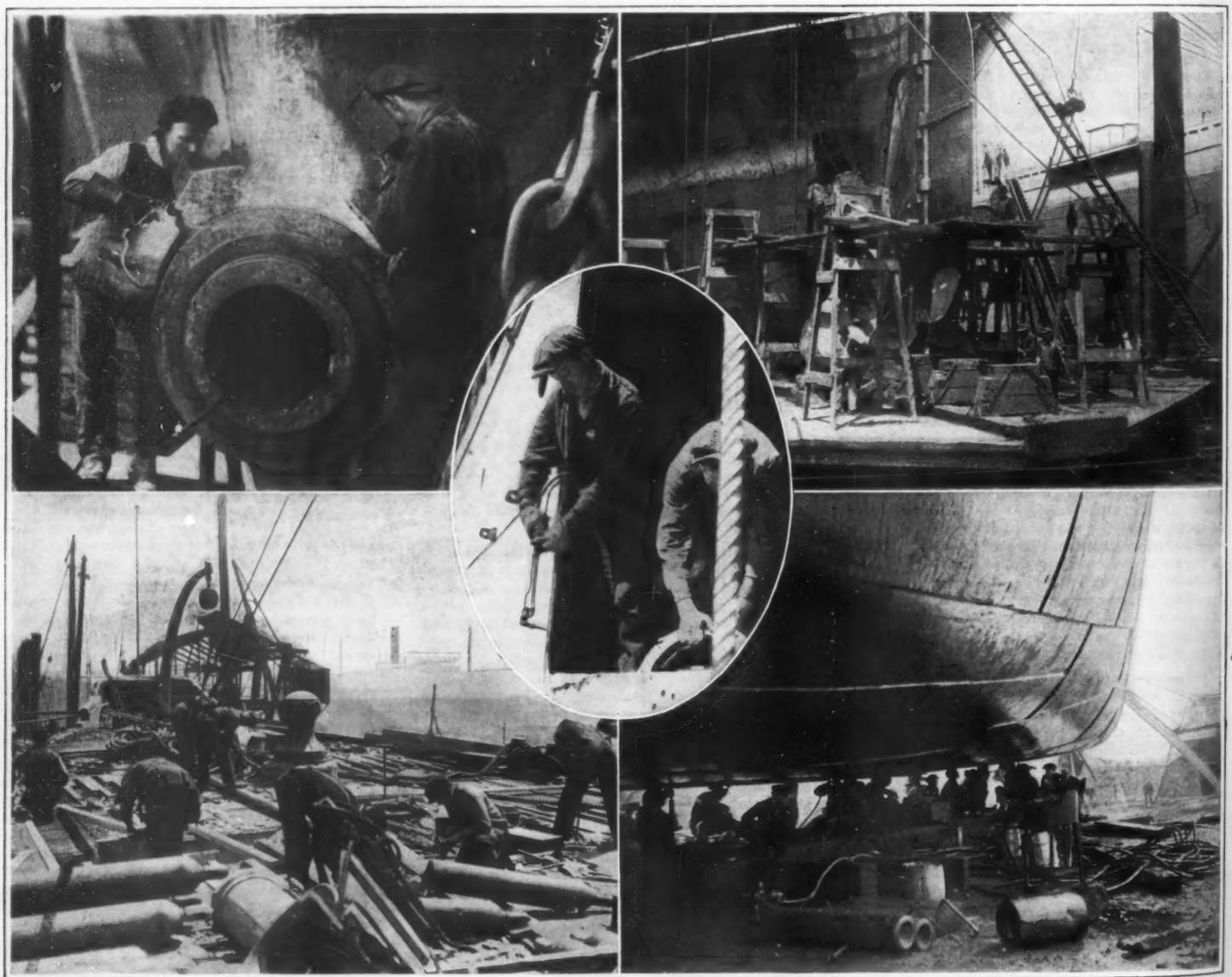
A large proportion of the ships also were provided with the celebrated paravanes which were recently described in the SCIENTIFIC AMERICAN. These necessitated the fitting of heavy plate work at the stem head of the ship and of special booms or outriggers, to say nothing of the heavy paravanes themselves and the lashings and gear that went with them. All of this material must be cut loose and taken ashore.

What a large amount of this material was called for is evident on a visit to any of our ship yards where the overhauling of merchant shipping is taking place. Along the full length of the docks at which the ships are tied up will be seen thousands of tons of this discarded material.

But the work of getting the vessels back to peace conditions does not stop with the mere removal of the special war material with which they were equipped. They are frequently in bad repair; for the urgent demand for shipping rendered it impossible to give the vessels the periodical overhauling, refitting, cleaning, painting, etc., to which they were accustomed in the days of peace. Consequently, in many ships there has been a depreciation of boilers and engines due to this enforced neglect, and consequently the repair bill is a heavy one and consumes an unusual amount of time. Frequently boilers and condensers need retubing, and the motive power, from foremost bearing of the engines to the stern tube of the propeller, has to undergo a thorough overhauling, involving the replacing of many badly worn parts.

Then there is the matter of painting. The least that even the most humble cargo boat should get is a coat of paint once every six months with a thorough painting of the ship's bottom more frequently than that. The rusty and neglected condition of the average cargo boat tells its own story, and in many cases it is necessary to give the hull a thorough cleaning down to the steel before applying a new protective coat of paint.

Gradually, the picturesque or hideous, according to the point of view, camouflage of the war is disappearing and shipping is coming back to the familiar black and white and gray of pre-war times.



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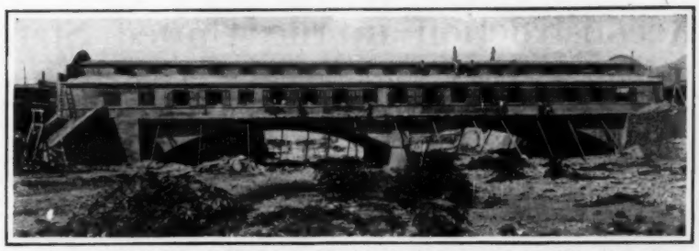
Upper left: Acetelyne burners at work under stern of ship on the stern tube. *Upper right:* Gang at work on propeller. *Center:* Cutting a new port through ship's plating. *Lower left:* Repairing the deck where the big guns have stood. *Lower right:* A gang at work under the fore foot.

Our dockyards are busily at work restoring merchant ships to their normal condition

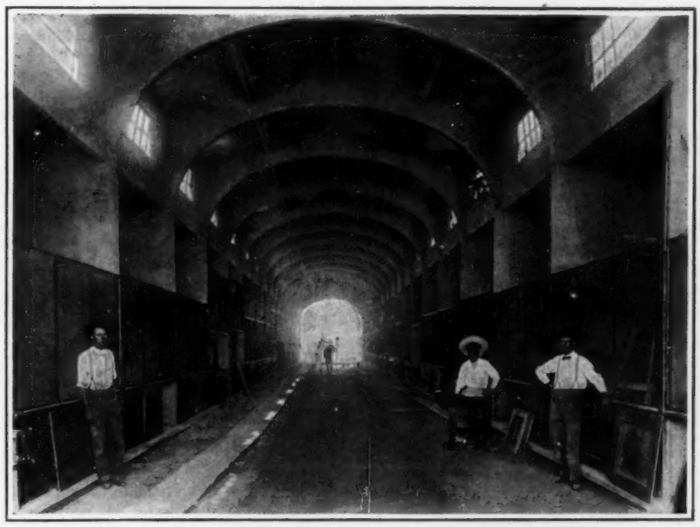
Unusual Bridge Construction

A COMBINATION bridge and market place has been constructed by the city of Monterey, Mexico, and this bridge which serves a double purpose is one of the sights of that part of Mexico. A shaded market place is almost necessary in the southwestern part of the continent to protect the produce and make marketing comfortable for the citizens. It may be that the people felt that they were scarcely getting the value of their money in putting up a simple bridge that was only necessary part of the year, as the river is dry except in the rainy season when it becomes a raging stream that is very difficult to cross. As the market place on top of the bridge is used all the year and means an income to the city in rentals, the wisdom of this unusual bridge construction is seen at a glance.

Heavy buttressed walls support the bridge. These are of solid concrete, but the walls, roof, and partitions for the booths are made of metal lath with a coating of cement. This greatly reduces the cost and is permanent and fireproof. A double row of windows on each side of the enclosed part of the bridge gives sufficient light and ventilation, so that it is always cool and pleasant on the hottest day. Monterey is evidently one of the enterprising Mexican cities which is keeping up-to-date in its construction work.



The market bridge at Monterey, Mexico, during a dry stage of the "river"



Interior of the bridge, showing market place and booths

Getting Behind the Scenes

WE are gradually find many things that are not as they have been made to seem and in nearly every instance it has meant the addition of some new item of manufacture to America's catalog. Some time ago we learned that much of the radium separated from its ores in Germany and Austria originated upon our continent and was taken abroad for the refining process whereby greater secrecy could be maintained. Our Bureau of Mines remedied the situation after much painstaking research.

More recently we have learned that Iceland spar, a mineral from which prisms are cut for polarizing apparatus is from North America and that the most useful varieties are not to be found only in Iceland and southern Austria as had been advertised. The rough spar was merely cut and finished in Germany and then sold to us at an ever higher price.

After years of hard work American microscope makers have finally convinced Americans, even those trained in German universities, that good instruments are made here. Now we are to have American-made polariscopes and polarizing apparatus, refractometers, spectroscopes and the like nearly all of which have heretofore been imported either because of prejudice against the home-made article or because the limited demand did not interest American instrument makers in the face of European competition.

Ought we not be as independent as possible in all these things upon which industrial progress so largely depends?

How Gun Parts are Heat Treated

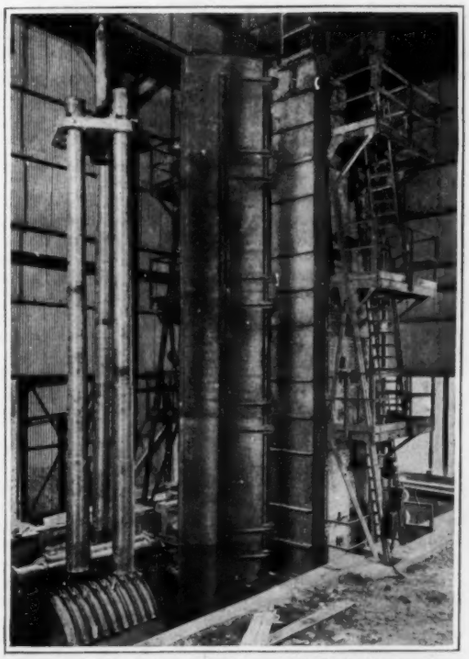
ALL parts of a steel gun, large or small, and especially the gun tubes, have to be put through a very important and delicate process known as heat treatment. This means the heating up to a certain fairly high temperature of the various parts and then cooling them in numerous ways. When the temperature to which they are heated and the time in which they are cooled are carefully regulated, according to certain known laws, the steel assumes its most finely divided and crystalline shape or grain.

The illustration shows one device for carrying out this important program in the case of moderately large gun tubes. The large tall chimney-like apparatus to the right is one of the heating furnaces. It has a long side door—in fact almost the entire side opens out. It is partly open now in the view, and out of it have just been brought three gun tubes or jackets, suspended from the carrier. They are being transported by means of a crane and are at almost a white heat. They are about to be lowered into a deep cooling tank, the outer edge of which can just be seen at the lower left hand corner. This contains oil usually.

After the gun parts are thus cooled they are again heated at a lower temperature which tempers, draws, or softens them slightly. The illustration is from one of the recent new American ordnance plants.

The Current Supplement

THE origin of our own solar system is a subject of perennial interest to the thoughtful man, and many readers will, therefore welcome a paper discussing the closely related subject *Stellar Evolution* in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2264, for May 24th, 1919, where the growth of stars is discussed at some length. The possible modifications in other heavenly bodies such as nebulae, comets, and neighboring stars when approached or even invaded by a given star are also discussed. An illustrated article brings to our notice the appearance and habits of a very primitive Indian tribe, *A Miniature from the Past*, not much advanced beyond the Stone Age condition yet



Removing gun tubes from the specially-built furnaces in which they receive heat treatment

our contemporaries and living in Arizona. In a long article on *The Significance of Dreams* we are introduced to the modern methods of employing dreams as indices of hidden desires and shown how very little reason there is to regard dreams as prophets. The illustrations on *Saving Our Cattle* serve to emphasize once more the constant efforts of our own Department of Agriculture to safeguard the people's health and to promote the development of good breeds of farm cattle. Closely related in interest is the discussion of *Sea Lions and the Fisheries Industries*, which endeavors to correct some popular mistakes concerning the sea lion's true relation to the economy of our marine food fishes. *The Present Status of Nitrogen Fixation* is of particular interest since the war has demonstrated that a country can make itself independent of natural nitrate deposits. *Nucleic Acid and Its Analytical Examination* is briefly discussed in the light of the experience of English commercial chemists working under the stress of war conditions. A much longer and well-illustrated article discusses in some detail *The Metallurgy of Copper* as handled by the electric furnace. The resulting micro-structure of the ingot and of the annealed copper is also discussed, and the article closes with a few paragraphs on the milling of the bars or sheets. The return of pre-war conditions on the high seas again draws the mariner's attention to his great enemy, fog, and the paper on *Scientific Signalling and Safety at Sea*, with its description of the device called a "collision predictor" will be of immediate interest.

Efficient Barn Arrangements

MUCH has been written concerning milking machines, litter carriers, and other mechanical equipment now found on thousands of American dairy farms, effecting labor economies, but the labor saving possibilities of carefully worked out dairy building plans, less talked about, are at least equal aids in obtaining greatest efficiency. A farmer of Victoria County, Ontario, whose principal dairy product is cream and who keeps pigs to utilize the skim, has barn, piggery, milkroom, engine room, granary and chopping mill, all so arranged that wasted motion can hardly be said to exist. He is a practical farmer, and his methods can safely be emulated by other dairyman. The fact that so many sets of farm buildings represent haphazard development after the first barn is outgrown explains partly why numerous American farmers are managing herds in premises woefully wasteful of steps, strength and time.

The piggery on this Ontario farm corners on the barn, filling in the corner between the two buildings is the combined engine and milk room and a shed. Directly above the engine room is the chopping mill, a belt running up through the floor from the engine below. Adjacent to the chopping mill, on the same level, but in the second story of the barn, is the granary, just a few feet away. A few feet from the chopping mill is one chute through which chopped feed descends into a feedbox in the piggery, another through which it can be rapidly "shot" to the cow-barn. The chopping mill can be reached so handily that it ordinarily is operated while other barn chores are in progress.

The combined engine and milk room contains a separator operated by power. The by-product, skim milk, is despatched to the piggery via a pipe line running from a point near the separator beneath the floor to the pig pens, where it empties in the swill barrels. This device is facilitated by the fact that the pig pens are on a lower level than the cow barn.

The shed at this corner is used in manure removal. Beneath the wall opening through which manure, conveyed mechanically, empties, is permanently stationed a sled or wagon. When a load accumulates, the horses are hitched in and the material conveyed to the fields.

Other ingenious farmers have perfected equally good barn arrangements, the labor saving worth of which can hardly be overestimated. The typical dirty, ill-smelling farm barn is an inconvenient barn, badly lighted, badly ventilated, hard to keep clean, constantly becoming disordered. The well-planned barn encourages good care, because it is easy. It is usually not difficult to persuade the owner of such a barn to equip it properly with carriers, modern stanchions, gasoline or other power, and the like.

Reconstruction in the United States

The Work of the Reconstruction Research Division of the Council of National Defense

By Our Washington Correspondent

IT is a strange anamoly that the government with the least officially formulated plans for reconstruction, should have better information and more of it, regarding the subject, than any of the governments of the war-ridden countries of Europe. Yet the work done by the Reconstruction Research Division of the Council of National Defense has placed at the disposal, both of the government and the business, financial and manufacturing cities of this country, a more complete compilation of reconstruction information than can be found any where else in the world.

The aims of the Reconstruction Research Division are two—to gather and make available the information needed to yield perspective for the exercise of rational judgment of this country's progress in its reconstruction and also to furnish background for the passing of judgment upon reconstruction proposals, and to keep intact and accessible the vital information upon the physical, financial and other resources of this nation which has been coördinated by the various war boards during the period of hostilities. Reconstruction research is intended to carry forward, keep up to date and perfect this vital information and to keep it in readiness should hostilities unfortunately be renewed; also to preserve its possibilities of utilization for the more probable needs of peace and especially to meet the requirements of any industrial and social emergency incident to reconstruction which might arise and call for governmental intervention.

The word "reconstruction" is frequently used to include all readjustments, all resettlements, all new work in rearranging the world or any part of it. For clarity, it is better if a sharp distinction be made between problems for readjustment and resettlement, which include nothing more difficult or new than a going back to peace conditions from a war footing, abolishing those regulations and practices which war made necessary and generally getting "back to normal"; and those other problems which are truly reconstructive, which come into being because many have discovered that it is neither possible nor desirable to return completely to a *status quo ante*, and that new ideas, new practices, new laws, regulations and proceedings have grown up during the volcanic eruption we call war, which must be retained, even if modified, if we are to make progress forward and not backward.

Almost invariably readjustment or resettlement problems come before those of reconstruction proper. Thus, before it is possible to reorganize an industry, it is necessary to get back the men who run it. Hence, demobilization is a resettlement problem rather than one of reconstruction. But if it is planned, for instance, to continue to utilize the labor of women where formerly only men were employed, then the problems of making places for both men and women, of creating new standards of both work and wages with their consequent effect upon production and prices, are problems of reconstruction.

It was obvious to the Council of National Defense that no resettlement, readjustment or reconstruction could be properly undertaken or best carried out if there was not available *all* the knowledge, information and practice which could be gathered together. No man works as well in any labor as he who knows all there is to know of what the other fellow has done, what other workmen are doing, what other agencies are planning to do. And it was evident, to any who followed the flounderings of a thousand business leaders in their search for information, to all who saw how one-half of the governmental machinery was running with no knowledge or comprehension of how the other half was revolving, that some central information bureau was essential if the ends of efficiency were to be at all served. Hence, the creation of the Reconstruction Research Division to carry forward the work which the Council of National Defense had begun and carried on for many months, even prior to the armistice.

Primarily for the use of the government, that duplication of effort be avoided, that one branch use to the fullest measure the existing facilities of another branch, that information as to "where to go to get it" be made as available as knowledge as to "who knows the most about it" the Reconstruction Research Division is serving the general public and is able to offer the manufacturers, bankers, business men—to any one really interested in any resettlement, readjustment or reconstruction problem, a wealth of material obtainable nowhere else in the world.

Not to catalog all its resources but to indicate something of their range, a few of the possibilities of this information service are here summarized. The Division is charting all Federal bodies having contact with demobilization or reconstruction, and possesses first-hand, up-to-date information as to the accomplishments and plans of each such body or bureau. Through its "field service" including 184,000 state, county and community organizations (including 16,000 women's units) the Division maintains direct contact with all state and local reconstruction activities.

The Division has every important report of foreign reconstruction activity proposed or accomplished, that reaches this country. It has the best information there is on foreign, commercial, industrial and financial conditions and prospects.

The Division is in touch with all the war administration boards, bureaus, and investigation commissions, as well as with all Federal Departments. It has much unpublished statistical information, ranging all the way from domestic price data and production estimates, wage data, labor supply reports, and the reported results of experiments in methods of handling labor problems—to notes of foreign production, the foreign labor and emigration situation, foreign market conditions, and finance. The Division knows which industries are making reconstruction readjustments the more promisingly, and thus can form much more reliable impressions as to what the future may be expected to bring, than is possible to the more restricted judgment of the average business group.

The Division maintains its own clipping bureau, supplemented by the service of the chief commercial clipping bureau. It sifts practically everything in print bearing on any phase of reconstruction. This material is classified, indexed and ready for reference. From these siftings the Division issues a daily digest of reconstruction news, intended for the Council and government bureaus but available to all whose reconstruction problems are such as to entitle them to the service.

There has been so much vagueness about the subject of reconstruction that it is refreshing to find a government activity concerning itself with its details in a thoroughly practical, workaday manner. There is very little theory and a great deal of practice in the work of the Reconstruction Research Division. Its compilations and publications are not expressions of opinion of some theorist but means of disseminating those facts on which, and only on which, a comprehensive reconstruction plan may be based.

One of its most elaborate pieces of work is a review of reconstruction activities of the world at large in which, in short and pithy paragraphs, the programs, suggestions, plans and acts of all the foreign nations which have turned a wheel in reconstruction work are summarized. A second volume will deal with the United States and all its reconstruction activities, and a third with those of the 48 states as distinct from the Federal government, a fourth with the chronology of Federal and miscellaneous reconstruction activities, including a complete list and publication of all orders of all war boards, such as the Shipping Board, War Trade Board, etc.

The Division is to publish a list of, and reprints of, the principal reconstruction programs as originated in the United States, and such foreign schemes and ideas as seem helpful to our problems—this means bringing together the diversified thought of all non-governmental but allied-to-government plans, such as, for instance, the reconstruction programs as outlined by labor, by church, by Red Cross, by manufacturing, societies, etc. A sixth volume will give a reconstruction summary by topics.

All of these will be printed and ready for Congress by June 30th and much of all and all of some of these are now available for reference and restricted distribution in mimeograph form.

It will be impossible here of course, much more than to mention these larger undertakings. But it should not be difficult to understand their value, or why, for instance, the initial report on foreign reconstruction work has been very eagerly sought by representatives of all foreign governments, or why it is so much in demand here by those who want a catholic outlook on readjustment problems.

Such subjects as water power development in Hungary, Germany's provision for returned soldiers, loans for agricultural workers in France, soldiers' settlement plans in Canada, community warehouses for farmers in Italy, preparedness for post-war export business by Japan, new engineering enterprises in Great Britain, are topics more or less elaborately treated in this unique report. Those interested in Secretary Lane's plan of soldiers' land settlements can take this bulletin and trace through it what is being done in this line in every country that has been engaged in war. Aerial postal service, readaptation of factories, emigration, the woman worker problem; here is information showing what all foreign countries have thought, said and done on these and a hundred other subjects.

There are four great files in the Division, in which are classified and indexed information nowhere else in the world available. The first is a clipping file, devoted to information as opposed to opinion. It is so indexed that there is no subject which can be considered under the general title of reconstruction which cannot be immediately found, making available all the magazine and newspaper and pamphlet reports on what has been done in that particular line.

The second file is a file of opinion, rather than of facts—it is so indexed that the published thought of any expert on anything which bears on reconstruction, is here made available. It is the expert on the stand without the bias of a particular employment—it is a forum where, if not all, certainly the greater number of the greatest experts in finance, trade conditions, factory organizations, to mention only a few subjects, can be heard.

The third file is locally known as the "24-hour file." It is a file and index of all governmental activities, but especially reconstruction activities, which is kept up to the minute. Any branch of the Federal government can ascertain from this exactly what any other branch has done, and is doing, up to the day before. More, it can ascertain what *all* other branches of the government are doing. The manufacturer who wants up-to-date

(*Continued on page 558*)

THE prime purpose of the Reconstruction Research Division of the Council of National Defense is to tap all available sources of information in this country and abroad to the end, first, of arriving at a working definition of reconstruction and readjustment and, second, to get the problems in connection therwith clearly and logically stated, and to render instantly available to the government and the general public the information gathered.

Not merely is it necessary in this task to examine the structural and business changes which are going on, but it is equally imperative to sense and to cull the thought of the world. In common with other countries America has in many ways broken with her past. New conditions and new relationships create new problems for nations as well as for individuals. Any intelligent conception of the labors of reconstruction must comprehend that the changes are as great in the thought and ideals of nations as in the strictly material problems, whether these be military, commercial or those having to do with labor.

Out of the metamorphosis must and undoubtedly will come a more orderly arrangement of our affairs in business as well as in private life, and we can best win to this readjustment if we can have the benefit of the impersonal analysis not only of what we ourselves are doing, but of what the rest of the world is doing to make the turn in our common lives. No one who has studied for months the questions of reconstruction and readjustment can speak dogmatically of them. The more reason why the facts and the thoughts surrounding them should be collected by and sifted through such a clearing house of information as the Reconstruction Research Division in effect is.

After nearly ten months of concentrated effort in this direction the Council of National Defense has more practical and illuminating information on the entire vast field than is elsewhere to be found within the United States—and all of it is at the service of the public.—GROSVENOR B. CLARKSON, Director, United States Council of National Defense.

The Case for Water Power

The Present Status of "White Coal" in the Eastern United States

IN the United States today there is approximately four or five times as much steam as water horse-power in use. The aggregate water horse-power, developed and undeveloped, is around 60 millions. In 1916 perhaps a trifle more than one-tenth of this was developed. This means that there is still undeveloped water power in the country equal to twice our present steam capacity. Of the undeveloped water power, about three-fourths is found in 13 western states, leaving one-quarter of the total, or some 13 million horse-power, for the East.

In the nation at large some 32½ million horse-power is created each year from coal—a fuel that will ultimately be exhausted. Of this total by far the greater part is in the eastern states. The tremendous water-power potentialities of the Rockies are more romantic than the numerous small developments into which exploitation of eastern water power would of necessity fall; but in view of the figures just cited, the latter alternative is not without its attractions. Before the interest of investors can be enlisted in any project to utilize the water power of the East, however, certain economic and legislative factors which in recent years have taught the capitalist some expensive lessons must be reviewed.

In the first place, drought in summer and ice in winter have withheld from the water wheel a constant source of power. The initial cost of building dams to overcome this was so great that companies which might in the long run have succeeded were unable during their infancy to compete with the steam engine. In addition, the high cost of transmission systems in mountainous regions has been prohibitive to some degree.

The total cost, in 1914, of installing hyrdoelectric plants appears to have been about $158 per horse-power. This includes everything, from dam to distribution system. If coal continues to soar, in time the comparison will be favorable to water power. At present it can only be said that increased efficiency in the operation of the hydroelectric plant might look forward to overcoming the difference. The best steam practice secures at the generator only 20 per cent of the energy stored in the coal, while the efficiency of the water wheel frequently exceeds 90 per cent. But at the same time, the rapid development of the steam turbine with its increased efficiency is working on the other side of the scale.

Real estate factors have been of considerable importance in retarding water-power development. The high value of the land required in industrial districts has been a handicap. In many cases railroads that follow the streams would have to be relocated in order to make possible a water-power development on an adequate scale. There is the great new dam in Tennessee, in connection with which over a million dollars was spent in transferring railroad tracks to higher ground Then there is a scarcity of really first class head sites; and when such a one is found, forestry laws are likely to lack adequate provision for land leasing. A legislative obstacle lies in the fact that many streams are of an interstate character; and while the experience of New York and New Jersey with the Palisade Park and the Hudson Tunnels proves that it is sometimes possible to get the same bill through both Houses of two States, it is never a simple matter. Moreover, long term franchises held by municipal heating and lighting companies frequently place new competition at a discount. And there is at least one engineering obstacle in the paucity of data on the geologic features of stream beds.

The report of the Pennsylvania Water Commission for 1916 gave the harrowing details on hydroelectric projects that have been started and stopped for various reasons. Some were begun at a time when capital was notably scarce. Many companies proceeded more or less by rule of thumb, without realizing the necessity for a complete survey; as a consequence poor sites were chosen that had subsequently to be abandoned. Hydrographic conditions were often overestimated, so that when it came right down to doing business the water counted on was not there. On the other hand, commercial surveys were frequently on an even more sketchy basis, so that the markets were not nearly so wide as had been anticipated. In three instances uncertainty as to the legal rights possessed by the companies blocked further progress. And of course all these known failures have introduced a big moral hazard.

In spite of all the difficulties and all the discredit brought upon water power in general by the failure of half-baked projects and recklessly promoted schemes, there has been genuine progress by water power throughout the East. Indeed, all the obstacles recited above are of the sort that can be overcome by intelligent attack. They have been so overcome, and on a scale sufficient to demonstrate the advantages to be reaped in overcoming them.

First of these is conservation of fuel. Second is the progress toward ultimate electrification of our railroads. Most of these follow rivers for the best part of their length, and have therefore this natural source of power right at hand. Then, too, water power makes electric lighting available wherever it is needed, which is not the case when we are confined to current produced by burning coal. Nor is it true that introduction of water power means the elimination of coal power; on the contrary, where steam is already used it can be admirably supplemented with water power.

Advantages which accrue less directly from the elimination of fuel burning are also numerous. The storage reservoirs in use with hydroelectric plants provide protection against floods during the wet season, while in the dry period water from the impounding dams greatly improves the sanitary conditions along the stream below. In addition dams frequently facilitate navigation.

That the advantages of water-generated power can indeed be made to outweigh the objections thereto when the final reckoning is struck is amply indicated by the showing of Canada. The Yukon develops 97.4 per cent of its primary central energy from water. Ontario develops 95.7 per cent in this way, in competition with convenient and reasonably cheap coal supplies. Manitoba shows a figure of 95.2 per cent, Quebec 94.9, British Columbia 89.8; Alberta develops 43.2 per cent from water although an abundant supply of coal is available. In the other provinces the showing is not so good; but even in Prince Edward Island 13.9 per cent of the power comes from the very limited watercourses. Saskatchewan is the one province where the

(Continued on page 558)

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

"Swamp Lands" in Florida

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of November 9th last there is an article signed by Secretary Lane, in the course of which a tabulation is offered of the amount of swamp land in the several states. According to this table, there are 19,800,000 acres of such land in Florida.

When a gentleman of Mr. Lane's standing makes, in a paper of your standing, such a bald mis-statement, protest is called for. There is not, nor has there ever been, half that area of swamp or overflowed land in this state. It is true that in 1855 the United States ceded that area to the State of Florida *as* "swamp and overflowed lands," and this is presumably where the Secretary found the figure; but the tract ceded simply did not exist, as swamp or overflowed land.

The site of this town, nearly 300 feet above sea-level, with nothing that resembles swamp or overflowed land within fifteen miles, was among the lands so ceded. Nearly if not quite a million acres of good land west of the Appalachicola River, land that is and has always been high and dry, was included in the cession.

The actual area of swamp and overflowed land in the State is not much, if any, more than one-fourth that given in Mr. Lane's article. That in the Everglades is now being drained, and the land is as rich as the Nile delta. On these lands it is hoped to settle some at least of the returned soldiers under Secretary Lane's plan, and the Florida legislature at its special session early in December authorized the officials in charge of those lands to cooperate in any way possible with the Federal Government to that end. But 19,800,000 acres!

De Funiak Springs, Fla. R. W. STORRS.

To the Editor of the SCIENTIFIC AMERICAN:

In reply to your inquiry, you are informed that, up to June 30th, 1918, swamp land patents were issued to the State of Florida for 20,201,660.52 acres, under the grant made by the Act of September 28, 1850 (9 Stat., 519).

Of these lands, 11,630,271.51 acres were selected before March 3d, 1857, and irrespective of their character as swamp or dry, were confirmed to the State by the Act of Congress approved on that date (11 Stat., 251).

The total area of the State of Florida is 37,546,240 acres, composed of 35,111,040 acres of land and 2,435,200 acres of water.

The records of this office give reason to believe that some of the lands claimed and patented as swamp, were not of that character, but no investigation has ascertained their exact area.

CLAY TALLMAN,
Commissioner of the General Land Office.

[It seems almost unnecessary for us to comment upon the reckless manner in which, simply because it has no better figures, the Department of the Interior has promulgated statistics known by it to be incorrect. The supposition that, even in such a watery state as Florida, over 56 per cent of the total land area could properly be classed as swamp and overflowed, is altogether an extravagant one. We have held this correction for some weeks in an endeavor to secure a reliable estimate as to the real area of swamp and overflowed land in the State, but nobody seems able to tell us, and the Commissioner is doubtless right when he says that this figure has never been determined. This fact hardly affords justification for substituting for the true figure one which is an undetermined number of millions of acres out of the way.—THE EDITOR.]

Making the Airplane "Safe?"

To the Editor of the SCIENTIFIC AMERICAN:

It is evident that Mr. Gaetan Ajello, whose letter, "How Best to Make the Airplane Safe," appears in your issue of March 8th, 1919, has had very little practical experience of flying. As his article might discourage research in a field which will in future be of the greatest value to aeronautics, I should like to point out some of his most apparent errors.

With regard to his classification of airplane accidents, it is quite true that more accidents have occurred at low altitudes than at high ones. The vast majority of these, however, have happened at training squadrons or schools and have invariably been the result of inexperience on the part of the pilot. The maintenance of correct horizontal balance in landing is purely a matter of instinct which comes as the result of experience.

As a forced landing is in most cases caused by loss of motive power, it is impossible for an aviator to be "compelled to fly low around the limited area which he has picked for his landing."

With regard to accidents at a high altitude his observations are entirely wrong. Accidents of this nature have three causes only—breakage of some vital part of the fuselage or wings, jambing of the controls or a collision. In either of the two former cases the pilot would have time to extricate himself before the machine gained too great a velocity.

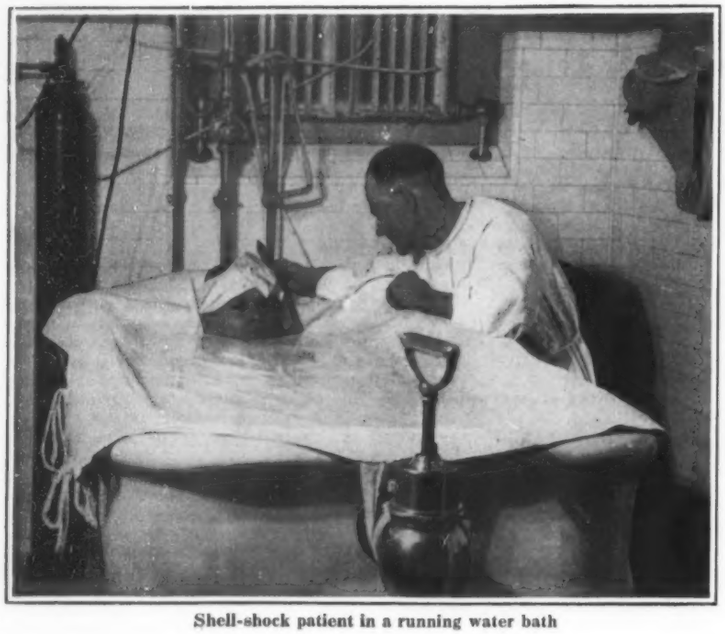
The greatest value of a parachute is in the case of fire—the nightmare of every aviator. In the case of tractor machines it is impossible to use extinguishers as the rush of air carries the stream away from the fire—the seat of which (the carbureters usually), it is impossible to get at in most machines. Side slipping does not blow out a fire except in very rare instances. The reason for side slipping is, that it carries the flames away from the pilot and that it is the most rapid method of losing height. Usually, however, if the machine is above 2,000 feet, the tanks blow up before the ground can be reached.

The type of parachute that must be developed is the one which pulls the pilot out of his seat when operated, not the type in which he has to jump over the side to open it.

The device your correspondent suggests to replace the parachute is rather obscure, but I take it that it is some type of collapsible lighting surface attached to the machine and dependent on its speed through the air for its lift. Now if this is the case it would be quite useless to prevent crashes due to loss of flying speed at low altitudes. For it follows that if the machine has lost speed enough to prevent its lifting surfaces generating lift there will not be sufficient speed for any auxiliary lifting surface to generate lift. Again, if the machine is being flown into the ground the pilot will not know until the moment of impact that he is doing anything wrong, when it would be too late for any device to work. I, therefore, fail to see the advantage of this device in preference to that of the parachute. The only possible use for it would be in the case of breakages or jams in the air.

Lieut., R. A. F.

London.



Shell-shock patient in a running water bath

Placing a patient in an electric bath

Making Over the Disabled Doughboy

Apparatus Used in Our Hospitals to Restore Our Injured Soldiers

By John B. Huber, A.M., M.D.

Photographs taken at Letterman General Hospital, Presidio, San Francisco. Copyright by Underwood and Underwood

IN base hospital work, while the war was on, the principal thing that was watched for in every seriously injured man, apart from infection, was shock or collapse. The men reached the base hospital by train twenty-four to thirty-six hours after they had been wounded. They had, the most of them, been long exposed to cold. Their clothes were covered with mud from the trenches, mingled with their clotted blood. Their bandages, blood soaked or else hardened from dried blood, were sticking in their wounds. They had been terribly jostled in transportation. Many were listless and apathetic, showing their profound physical exhaustion and their shock (oftentimes worse than actual wounds) from their cumulative exposure to concussion from the modern high explosives. Their faces were drawn and pinched. Their eyes were sunken and lustreless. Their skin was cold and suffused with a clammy sweat. Their pulse was irregular, weak, wobbly, easily compressible, and the diastolic pressure, taken by the sphygomanometer, was woefully low. Their one idea was to sleep. They had slept marching. They had slept fighting. They would sleep during painful dressings and operations. But before they were allowed to sleep they were given a hot bath and hot soup and a very stiff hypodermic injection of morphine; all uncomfortable dressings were changed; proper fixation was applied to fractures.

In the most of them, 24 hours later, after rest and comfort, there was a vast difference. The drawn and anxious look had disappeared from their faces. In place of apathy they were alert and bright; their color was fine; their pulse of good quality.

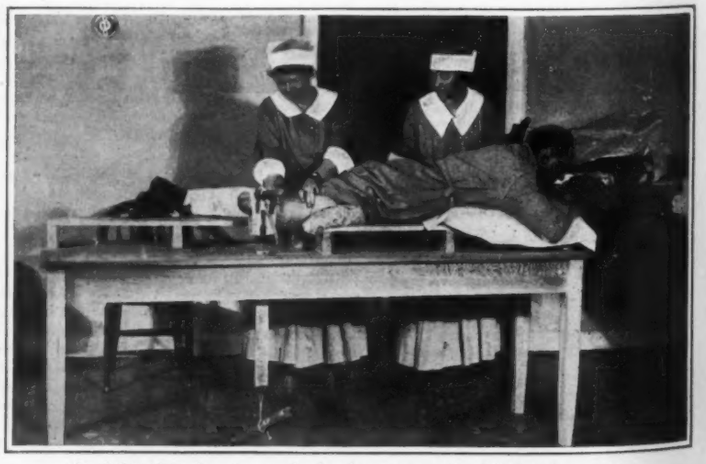
I cannot forbear reproducing here an impression set down by Philip Gibb, who did such epic writing about the western front. He observed the astonishing way in which the military youth recovers from the overwhelming fatigues of battle and from the breaking strain of the kind of fighting that has been done in this war upon every quivering human nerve. Britishers, upon the last lap of their rearguard actions, were tired almost to death; yet, when they were called upon to make one last effort after six days of fighting and marching, staggered up to their work like men who had been chloroformed, with dazed eyes, gray and drawn faces, speechless, deaf to the words spoken to them, blind to the menace about them, seemingly at the last gasp of strength. Footsore and stiff limbed were such fighters, feeling like old, old men.

Yet—and this was to the splendid war correspondent the astounding thing—after a few days' rest these heroes were young and fresh again; "upon my faith it was almost impossible to believe they were the same warriors as they stood about in the evening sunshine, like men on a village green taking their ease in times of peace. Their kilts were stained, but they had washed off the dirt of battle, shaved, cleaned their steel hats, and the tiredness had gone out of their eyes and youth had come back to them."

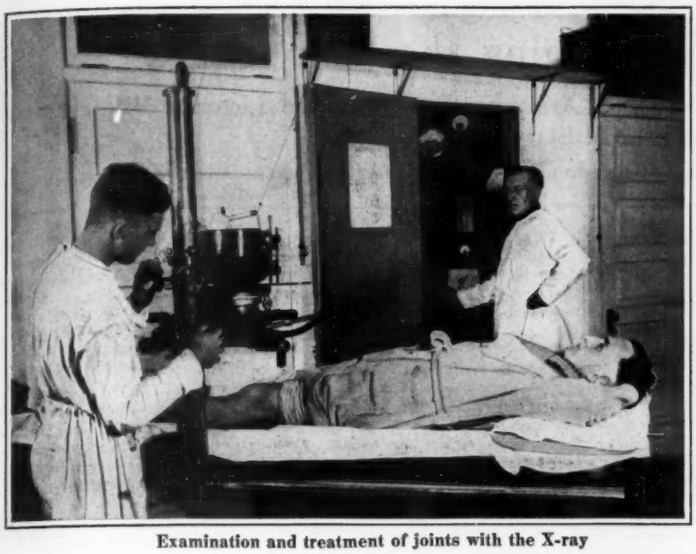
Seldom indeed, even in the most awful of human stresses, are we left without a few ounces of latent energy, upon which recuperation may be based. We have in our bodies, all of us, a latent potency; our resources of mind and body, which we are able to draw on for supreme occasions, are far beyond any idea the most of us have of our capabilities. Our bodies are wonderfully blessed with margins of safety, over and above the maximum required by normal activity; with factors of safety, just as engines, bridges, and other structures are so constructed as to be capable of withstanding not only the stresses of reasonably expected maximum loads, but also those of several times such loads.

So it is that so many of our boys have pulled through, to return to us, the most of them sounder in body than when they went "over there" by reason of the magnificent physical training they have—many of them, however, disabled in one way or another. And so it is that Uncle Sam, aided so nobly by many friendly nongovernmental agencies, is with their help accomplishing wonders in restoring those maimed boys, if not to their old shape, at any rate to health and to useful vigor. Especially must the majority of the men now in our war hospitals and in our convalescent homes depend for most of their present treatment, and for their future efficiency on physico-therapeutic measures—massage and passive motion, the beneficial effects of heat and light, the X-ray and electricity, of baths, of the baking of

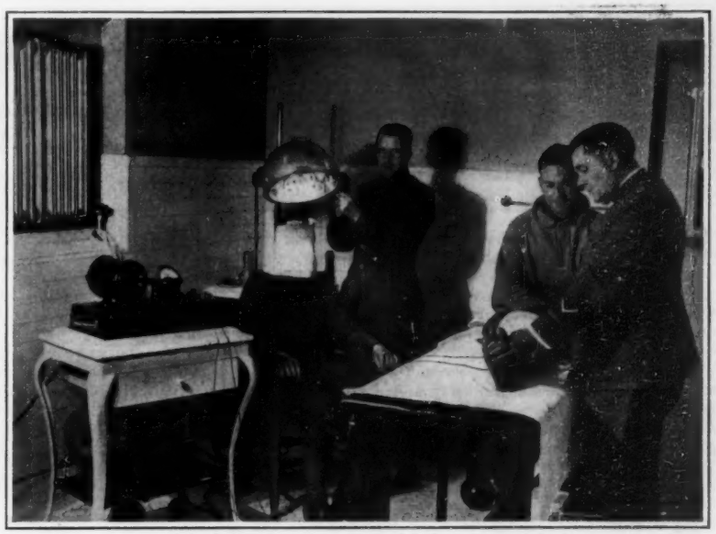
Stiff limbs massaged to restore their flexibility



Straightening the stump of a leg by means of weights and massage



Examination and treatment of joints with the X-ray



Subjecting a patient to the light ray treatment

joints and the straightening of stumps. In due course come simple exercises and gymnastics, physical instruction, mechanotherapy, eventually skilled movements, games and handicrafts, graduated industrial training; and so fitness for many of the occupations in which workers are now so sadly needed throughout the length and breadth of our land, now so secured in peace by the courage of those same disabled men and of their glorious comrades.

Many of the measures just mentioned are excellently set forth in the illustrations accompanying this article. The salutary effects of the hot bath for those acutely shocked have been touched on; the hot bath is equally salutary in the many cases of chronic shock now under our care. So beneficient, indeed, was heat found during the actual war service that ambulance trains which brought the wounded from the field stations to the base hospitals were whenever possible, heated to the temperature of the Turkish bath. The electric baths are serviceable by reason of their stimulating effects, both general and local.

Baking out stiff joints with electric heat and light

Heat in the form of sunlight, the electric light and the baking of joints, has been found most efficacious, softening up scars and other tissues, so that contractures could be manipulated and the joint the most speedily restored to its natural function. The "healing expectancy" of wounds was on the other side, in some cases at least, shortened a fortnight by means of heliotherapy, associated, of course with other measures.

Massage, begun early, is most invaluable in the straightening of stumps (in conjunction with apparatus suitable to the end in view'; and in preventing the permanent ankylosis or immobilization of joints by reason of adhesions, such as must otherwise be stretched or broken in the most painful ways if serviceable members are to be assured.

Treatment by the X-Ray has given excellent results, especially in those cases of otherwise intractable neuralgia by reason of nerve fibers that have become incarcerated in any wound or operation cicatrix. Such nerves are relieved of compression, as the Roentgen-rays soften up the fibrous tissue. Even deep nerve trunks feel the salutary and grateful effects. With rapid return of nerve functioning the electric muscular reactions return at the same time happily to the normal.

Here, in somewhat more detail, are the plans approved by our War Department, which defines reconstruction as complete mental and surgical treatment carried to the point of maximum functional restoration both mental and physical. To secure this result all methods recognized by modern medicine as conducive to cure are utilized.

The medical treatment is not supposed to end with the physical cure. Functional restoration is the final aim. The physical rehabilitation of disabled men is peculiarly dependent on their mental attitude. The more serious the disability the greater the danger of mental depression and the indisposition to respond to medical and surgical treatment. There is, therefore, educational work to be done which should begin with the soldier's arriving at the stage where he begins to worry about his future. His attention is diverted by simple recreation, reading, movies, games, handiwork occupations and the like—with a view to securing a genuine interest in the attainment of some end worth while—the end in each given case most certain to hold the attention and to claim the best efforts. The beginning is made at the bedside with handicrafts of various kinds grouped under the term "occupational therapy." The man able to leave the ward and who can be benefitted physically by technical-training, has the chance of working at specific trades, either in the curative workshop, in specifically provided classrooms, or out of doors. Trained women are benignantly engaged as teachers in occupational therapy; in addition many men teachers have been secured from the convalescents, disabled soldiers who are already skilled in their vocations; and from the enlisted personnel of the army secured by transfer or by induction of registrants disqualified for general military service.

Thus are our noble soldiers taught, when possible, to avoid the crutch habit; and are being turned into serviceable peace citizens, rather than into candidates for the soldiers' home.

Simple printer, flat rack, and pans which form the portable laboratory equipment for the itinerant motion-picture man

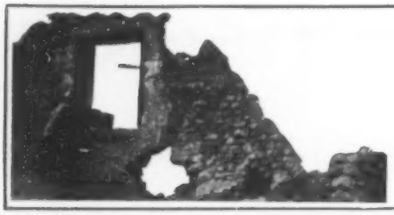
A Suitcase Motion-Picture Laboratory

THERE are times when the motion-picture man needs a small laboratory equipment that he can carry about, particularly when he is working in distant fields.

Heretofore, owing to the lack of suitable equipment, it has been the general practice to send the undeveloped negative back to the home laboratory, where it could be developed in the regular way. This procedure, however, has a great disadvantage, namely, that the cameraman does not know whether his film is good or not, and by the time he receives word from the home laboratory, he may be too far away to "shoot" the scene or scenes over again, in the event of poor results the first time.

So it follows that there exists a considerable demand for a portable laboratory. It has remained for Ralph Stineman of Los Angeles, Cal.—a place where almost everyone is interested in motion pictures—to devise a motion-picture laboratory that fits in a suitcase. Briefly, Mr. Stineman's apparatus consists of a simple printer of the continuous action design, a set of three flat pans, and a flat rack for holding the film.

The negative or positive film is wound on the flat rack, which is provided with a spirally-wound strip which serves to hold the film in place. This flat rack can be placed in the developer, fixer, and rinser in due turn. As for the printing machine, it is simple and hand-operated, a heavy flywheel providing a uniform rate of movement.



Photographing the War

Work of the Signal Corps, U. S. Army, in Recording the Pictorial History of American Military Work in France

By C. H. Claudy, Special Correspondent of the SCIENTIFIC AMERICAN in France

PHOTOGRAPHY has had a great part to play in the war, and has been a very vital factor in almost all military operations. The work of the aerial photographer and those who develop and print his work in record time, that artillery or other officer may have the data thus obtained, has added a new laurel to the crown worn by Daguerre.

But now that the war is over and as time heals the scars on the terrain, and industry and patriotism unite to rebuild the shattered buildings, photography will be longest remembered in connection with the war for its preservation of sights and scenes which must soon disappear, and, pass from the recollection of living men.

Both French and English governments have made very complete pictorial histories of their parts in the great conflict. Luckily for both the historian and the military authority, the United States had, in the Signal Corps, an organization able to cope with the far-flung activities of America in Europe. And if our collection of photographs compares favorably with those of other countries, if our "movie" films of the war will bear viewing side by side with those of France and England, and if our military authorities can prove a point or build up a new science of war in the future because of the existing pictures, it will be because the photographic division of Signal Corps was very much on the job.

The United States entered the war April 6th, 1917. On July 27th of the same year the first Signal Corps photographic laboratory was located, in the plant of a film company, just outside of Paris. Its personnel consisted of one officer and one private.

The Laboratory and Photographic Division, as this organization is called, was formed not only to compile a complete pictorial history of the American participation in the war, but to assist in supplying the American periodicals with both news and propaganda pictures. In this connection, it functioned through the Committee on Public Information, but was in no way connected with that body except as the means of supply of the pictures which the Committee distributed.

As might be expected, with the rapid growth of shipments of men, American participation in the war speedily demanded a much more extensive force and much larger quarters for its photographic units. So that in February 1918, with eight officers and 28 enlisted men, the laboratory moved to a motion-picture plant at Vincennes (just beyond Paris), where more space and better equipment were available.

The work in the field was done by what were known as Photographic Units, in almost every case consisting of a commissioned officer, a sergeant, first class, and a private, first class. One such unit was attached to every division, every corps and every army headquarters in France, and as many as were needed were stationed in England, Italy and Russia.

These units did both "movie" and still work, often under fire, often at the front, but, as well, behind the lines, in the path of both advance and retreat, picturing everything picturable which might be of future or was then of present interest. There has been no military movement of any importance that has not been photographed. There is no regiment which has not had its place in the pictorial files. There has been no evidence of American ingenuity in any of the sectors under American control which has not been preserved in picture form.

This is the more remarkable when it is remembered that the American army officer had had no experience of European war methods. Many officers of the Allies grew up with the war. The American officer was pitched headlong into a full grown war. In many cases he did not appreciate what pictures might mean, and not infrequently the Photographic Unit had to fight both red tape and an old-fashioned notion that pictures were of no importance.

The photographic units were composed of trained photographers, men who knew cameras and camera work, and often, as well, men who knew pictures from both the pictorial and the news side. The result has been a really wonderful collection of pictures, how wonderful no one in America really knows, both because of a lack of adequate distribution machinery for pictures at home, and because of the absence, at the present moment, of any legal method by which these photographs can be made available to the American public, of which anamolous situation more in a moment.

Filming a truck train unloading troops

The photographic units had occasionally some strange orders to deal with from swivel chair officers at home, as in the case of the photographer who was solemnly assured at Washington that the engineers, having lumber, would be glad to build him a platform "to one side of a trench" from which elevated viewpoint he might get a good movie view of an attack!!!!

This sounds funny, looking at it from a close view of the battlefield, but it is nothing like as humerous as that officer who made written request for a picture of a battle with certain specified objects much desired to illustrate a lecture-room point. They included a river in the foreground, with troops crossing it under fire, a battery to the left, in action, protecting said troops, and the Boche retreating in the background.

If, however, the photographic officers and their men did not exactly get platforms erected from which to make movies of the battle in progress, they did, more than once, risk their lives to get movies of fighting, even when to stick anything like a moving picture machine over the top was to invite a perfect rain of machine gun bullets. The service was anything but without danger, one officer was killed, one soldier wounded and made prisoner, and three other privates were wounded, which is well in proportion to those other casualities of the fighting forces, compared with the number of men from which they come.

At the present time the Photographic Division consists of fifty-four officers and 418 enlisted men and clerks. By no means is the work all finished, and much that could not be obtained during the combat has been made available since, and positions, towns, formations, defenses, etc., are still being photographed. So far the Photographic Division has developed 36,574 still negatives and 594,277 feet of original moving picture negatives. These negatives of both classes are filed and indexed in such a way that any one can be found at almost a moment's notice. For instance, if some one wants to know what the second company of the sixth regiment of Marines did on such and such a date, and a picture was made at that time, it can be found, instantly. Or if some one wants to know what the town of Etain looked like on a certain date, it can be found. If any portrait is wanted it is findable, instantly, if it exists. In other words, everything is cross-indexed and up-to-date so that there is no time lost in getting at the existing picture when it is wanted.

Somewhat the same system exists with regard to the moving picture negatives. They are in small sections, of course, but so classified that on demand any variety of film can be made up. Thus, an artillery authority can have one showing only artillery work, or a medical officer can have one showing only hospital work, or an S. O. S. may get a movie film of any number of reels he pleases devoted entirely to transportation or any other subject, merely by specifying what he wants.

In addition to making and classifying these films, the Photographic Division has turned out fourteen 1,000-foot reels under the title "A. E. F. Weekly" which are shown to soldiers all over France, thus keeping the rank and file of the army in touch with what its various parts are doing, and five 1,000-foot reels called the "S. O. S. Weekly" for display at the various base ports—it was also used in "The Race to Berlin." Many special feature films have been made, showing also the histories of the various staff corps in the A. E. F.

Of the organization of the laboratory it is unnecessary to speak except to say that it gets things done. A personal visit to the laboratory shows a set of soldiers who apparently thoroughly enjoy their work, and who have

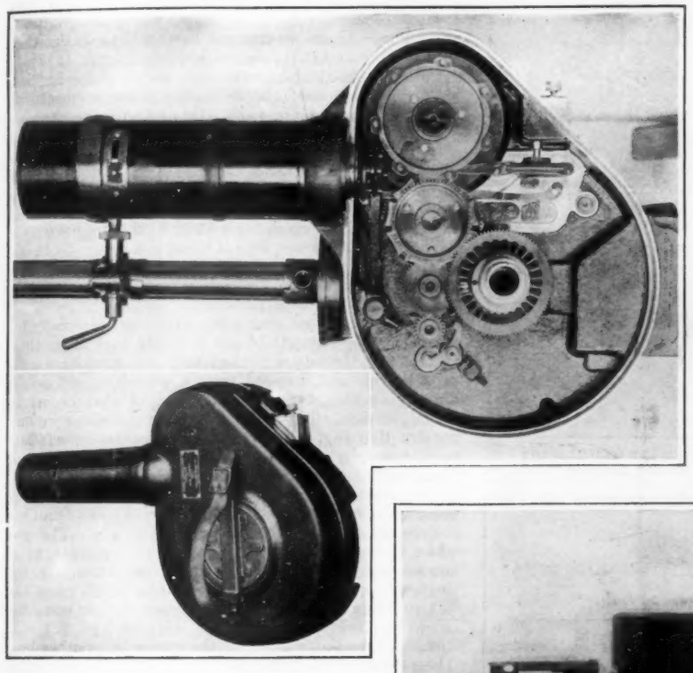
Assembling, and editing and titling motion-picture reels

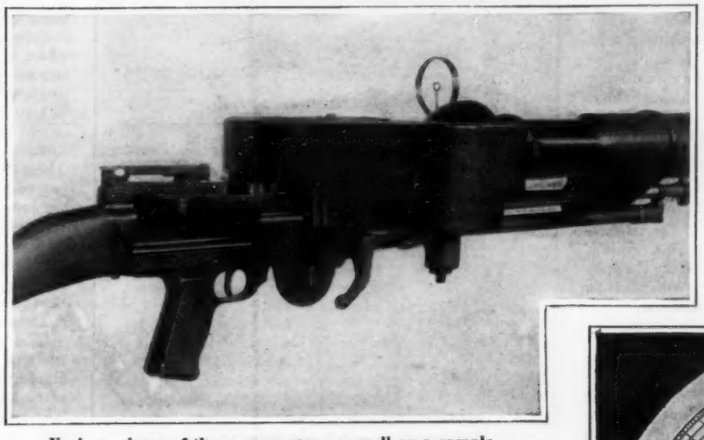
A group of workers in the cutting room

quarters, food and shelter close to the laboratory which are more than comfortable. The laboratory itself works under high pressure and turns out prints and films as ordered by military authority with surprising speed, but with due regard to photographic permanence.

Mention was made of the curious fact that there is no way by which the American public can get at these photographic records. This is no one's fault, apparently, but simply a lapse or gap between the cessation of function of the Committee on Public Information, which body formerly distributed the war pictures sent it by the Signal Corps, and the creation of some new distribution machinery. It is illegal for the United States army to sell its property, and it is equally illegal for it to give it away. Photographs here available can only be put forth for official purposes! Inasmuch as one of the reasons why they were made was to show America what her sons did and how they did it, this is a condition which should be, and doubtless will be, changed as soon as Congress is shown that a law to permit some permanant form of distribution at cost of prints, is a necessity.

Eventually, of course, all these still and moving picture negatives will be brought to Washington and there kept on file. Long before that happens, a united protest to Congress on the part of all interested—and that means every illustrated periodical and every collector, every parent of every soldier and every library, museum and school in the nation—should get the necessary legal steps taken to make available to the whole of America, America's pictured participation in the great war.





Various views of the camera gun, as well as a sample exposure made on the film

Making the Machine Gun Shoot Pictures in Place of Bullets

IN casting about for a suitable method of training aviators in aerial marksmanship, it was the British who first introduced the so-called gun camera. This device in its early form was simply a camera patterned after a Lewis gun, with a long lens barrel in place of the usual barrel. The gun camera was then a cumbersome contrivance; its operation did not simulate that of a genuine Lewis gun; it carried plates for 12 exposures only; and each exposure called for a manual operation.

Then the United States entered the war, and among other things the matter of a satisfactory gun camera came up in due course. As a rush job, the British gun camera was not at all bad; but after a while the American camera designers came forth with an idea for making the gun camera a separate device that might be attached to any standard Lewis gun. In that manner, they pointed out, it would be possible for an airman to obtain more realistic training. Again, more realism called for a camera that could make 100 exposures at one loading, and like the machine gun could fire in "bursts" and continue firing automatically as long as the trigger was under pressure

The gun camera in its perfected form weighs only 13 pounds in all, and has a lens barrel but 8 inches long and 2½ inches in diameter. It is of metal construction throughout. The film magazine is oval shaped. It is fitted with a Lewis gun magazine lock, which serves to fasten the film magazine in place.

Soon after the gun camera was introduced arguments arose at the training fields as to which aviator first shot the other, when both showed hits on their film. This necessitated the introduction of some form of time indicator. At present the gun camera in photographing a hit also registers the time on the same image.

It was believed at first that the aiming of the gun camera would have to be done mechanically, and one had visions of intricate gears and other mechanism. But the problem of aiming was solved by a system of mirrors.

The gun camera is properly registered with relation to the sights of the machine gun to which it is attached by first sighting the machine gun on a point a definite distance away, and then moving the camera so that the point of the bisecting lines of the "graticule" fall exactly on the point where the gun was sighted. Suitable clamping members then insure the accuracy of aim.

In place of the explosive force of the usual cartridge, something had to be introduced in the gun camera for driving the mechanism. The designers in the present and latest model have made use of a spring, which is wound with a handle similar to that employed in winding phonograph motors. The spring is fastened directly to the shaft that turns the five-inch reel and through to the Geneva cross movement which causes the intermittent action of the shutter and film-shifting mechanism, each time the gun is fired. The film is standard motion-picture stock, and in the gun camera it travels from a spool in the small end of the magazine, past a light trap where it is exposed and thence to a reel five inches in diameter at the larger end of the magazine, where it is stored until developed. Each gun camera is ordinarily provided with three magazines, which may be loaded in daylight.

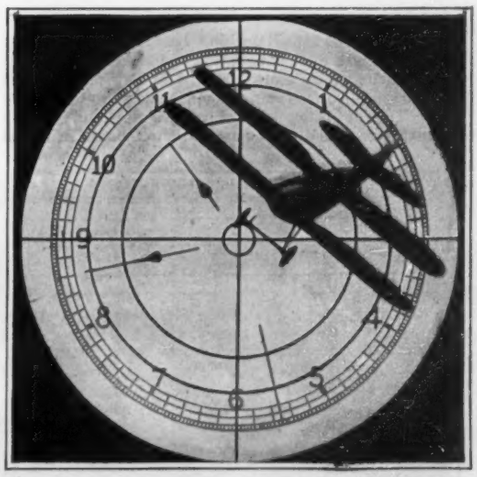
The "hits" are recorded on the motion-picture film in the form shown in the smallest of the accompanying illustrations. The crossed lines serve to indicate the accuracy of aim with relation to the airplane photographed, the white clock dial indicates the exact time even down to the second. A glass plate called a "graticule" is interposed in the lens barrel at the focal plane of the lens, which means practically in contact with the film. The graticule carries the crossed lines and circle, which are photographed in each image recorded. The developed images serve to indicate whether a given "shot" would have proved vital or not in actual combat.

Details of the gun camera are given in the accompanying engravings. The picture on the right is a reproduction of a photograph snapped with this apparatus, showing that the gunner just missed the chassis of his opponent and that the "shot" was fired at 10:43.

Connecting Staten Island with Manhattan

TOPOGRAPHICALLY Staten Island belongs to New Jersey. On the north and west it is embraced within the arms of the neighboring state, being separated from it only by the channel of Kill van Kull, barely a quarter of a mile wide, and the still narrower Arthur Kill. The island lies more than five miles from Manhattan, and its nearest approach to the rest of the State of which it is a part is at Fort Wadsworth, where a full mile of water separates it from Bay Ridge. At their most constricted part the Narrows are wider than the widest part of the Hudson River. So that in every way Staten Island is disconnected from the other boroughs of Greater New York. And, yet, it is a part of the big city and should, therefore, be entitled to some of the rapid transit facilities which have been developed to such an extensive degree in all the rest of the boroughs. At present the only way of reaching Staten Island from Manhattan or Brooklyn is by ferry, and in foggy weather, when navigation is slow, if not positively dangerous, Staten Islanders feel their remoteness from the heart of New York. During the recent ferry strikes the complete isolation of Staten Island then threatened, showed the imperative necessity of tunnel or bridge connection with the rest of the city.

When the Brooklyn Fourth Avenue subway was first projected, plans were made to run a line across the lower end of New York Bay to Staten Island. This would involve a tunnel some two miles in length, for it would hardly be practicable to tunnel under the Narrows at their narrowest point, because of the depth of water there. This extension of the Fourth Avenue subway has not yet been built, although the rest of New York has been widely extending its subways and elevated lines. In the meantime Staten Island, with its excellent frontage of deep water for shipping and its vast acreage of unpeopled land has remained undeveloped while its citizens have been paying increased taxes to increase the borrowing capacity of New York and help it pay its rapid-transit bills. Under these conditions, it is very natural for Staten Islanders to start an agitation aiming to extend rapid-transit facilities to their own portion of the city. They are not content to be connected to Brooklyn, feeling that this would be an indirect way of reaching the heart of the city. Brooklyn rapid-transit lines are already congested and would hardly furnish the necessary facilities for additional passenger service to and from Staten Island. The trip to Manhattan by way of the Fourth Avenue subway, considering the fact that stops would have to be made through Brooklyn, would probably take longer than the present ferry ride direct from the foot of Manhattan Island. It has, therefore, been proposed that a direct line be run from St. George, Staten Island, to the Battery, Manhattan.



Our front-page illustration shows some of the various proposed routes. Route A is a tunnel extending from the Battery to Ellis Island, and thence to Staten Island. This would connect with the Seventh Avenue subway line, so that Staten Island would be brought into close touch with the business part of New York, and also with the theater district. This would have the advantage also, of providing direct tube connection between New York and Ellis Island, and a separate tunnel could be run over to Communipaw to connect with the Jersey Central lines, which now have no tube connection with New

(Continued on page 558)

Better Packages and How to Know Them

How Government Tests Packages to Improve Design and Develop New Containers for Export Shipments

AN American Railway Express Company official recently made this statment: "It is an acknowledged fact that the average American business man regards a satisfied customer as a direct asset to his business. He would do nothing that might jeopardize his good relations with that customer. But if the goods he sent the customer arrive in bad order, if the contents are damaged or pilfered because they were exposed during the journey, or if, may be, entire shipments are lost because of inadequate marking or insecure packing, the customer may not wait long for explanation, but place his business elsewhere."

The importance of the box industry is but little appreciated. A bulletin of the U. S. Forest Service states that box makers in the United States use 4,547,973,180 feet of lumber annually, of which softwoods constitute 3,138,278,019 feet, or 69 per cent, and hardwoods 1,409,695,161 feet, or 31 per cent of the total. Practically all of the wood used for boxes is the product of the sawmill and therefore forms a part of the annual lumber cut. Based on the production in 1912, 11.6 per cent of all lumber produced in the United States is converted into boxes. In fact, the manufacture of packing boxes and shooks, crates, crating, fruit and vegetable packages and baskets, is the second largest wood-consuming industry of the United States.

The manufacture of boxes in the United States is conducted on a large scale in certain regions determined by the supply of raw material and the markets for the product. The manufacturing industries turning out products usually shipped in boxes, and the intensive production of fruits and vegetables for wide markets are the consuming channels calling for large box supplies. Among the leading box consumers are manufacturers of oil, packing-house products, canned goods, groceries and tobacco, clothing and dry goods, the manufacturers of hardware, tinware and machines, growers of fruit, berries and vegetables. Crates are used in large quantities by shippers of furniture, hardware, machinery and stone. There are innumerable special demands for boxes and crates, but on the whole it is manufacturing and intensive fruit raising and market gardening which create the demand for boxes, and a careful analysis of the centers of these activities, together with a consideration of the sources of timber supply, will explain the widely varying relative importance of the industries in the several States and regions.

Nearly three-fourths of all the boxes, crates, crating, etc., are manufactured in the region east of the Mississippi River and north of Tennessee and North Carolina, which, owing to the extent of its industries, offers the best market for boxes, and also embraces or is contiguous to the sources of the woods most used in box making.

What is a Good Box?

A properly designed packing box is one which has enough strength in each part for the purpose for which it is intended and no more strength in any part than is necessary to balance the average strength in every other part. The data necessary for designing such a box cannot be obtained from observation of boxes in actual commercial service, because the observer has comsees the box only after it pletely failed. He does not see the and he beginning of the failures; quently does not see and consewhich cannot measure the hazard completes them. A failure frequently bears evidence in itself of the cause of the damage; but there is no way of determining from a study of the failure the amount of force exerted by the damaging cause, and in cases where several causes have been active it is impossible to identify each of them. On the other hand, laboratory studies (made at the Forest Products Laboratory, conducted by the Forest Service at Madison, Wis., in coöperation with the University of Wisconsin) combine practical experience, which is a knowledge of the designs in use, of what lumber is available, and of box factory practice, with accurate scientific tests made on the package itself, packed as in actual service and subjected to strains that approximate actual transportation conditions.

One test that the packing case has to withstand before it receives the official sanction

A poorly made wooden box after shipment by express and parcel post

Compression-along-an-edge test, as its name implies, is a steady and constantly increasing pressure (measured in pounds) applied along any edge and with the opposite edge diagonally through the box in a direct line with the pressure exerted. The corner-wise test is applied in the same way to any corner of the package with the opposite corner in a direct line with the pressure. These two tests measure the strength of the box in withstanding any external pressure and to a limited extent approximate the hazard of the lower tiers of boxes in a pile. By themselves these tests are insufficient to determine comparative weaknesses in the various factors that enter into properly balanced construction.

Another very good test is the drop test, especially for comparing the strength of one box with that of another. In this test the box is packed with the actual contents as in service and dropped from a predetermined height directly on the corner, which is a fall that occurs in actual service. The value of the conclusions in any constructive way, is limited, however, because one failure runs so rapidly into another that the observer does not always get the true measure of the weaknesses.

The most practical method yet devised for testing packing boxes is the revolving drum test. The drum is a hexagon-sided machine and revolves slowly. The box to be tested is packed with the actual contents, as in commercial service, and placed in this drum. In the drum are arranged a series of hazards, which cause the box to follow a regular cycle of drops, falling upon the sides, top, bottom, ends, edges, corners, and flat wise upon a projection similar to the corner of another box. These drops simulate the usual hazards of transportation, excepting the heavy static pressure received by a box in the lower tiers of a pile, which is secured by means of the compression-on-edge test described above.

As the box moves on from one drop to the next the observer notes the beginning of the failure of the weakest point in its construction and follows the development of that weakness until the box entirely fails and lets its contents out.

The weak feature of the box may be too few nails, nails of too short a length, nails driven in a crack and thus having no great holding power, or some other form of nail failure; and the tests clearly show this weakness. The material in the sides, top, or bottom may be too thin, so that the shocks of the falls pull the wood from

(Continued on page 559)

Looking into the mouth of the drum that tests the ability of packing boxes to meet obstacles and come out whole

The results of some tests where boxes were subjected in a few minutes to all the wear and tear of a long journey

The Cockpit of the Transatlantic Seaplanes

ANY landsman who may have been so fortunate as to be admitted to the chart-room and shown the method by which the ship in which he is voyaging is navigated, particularly if this should happen in foggy weather, will quickly understand some of the difficulties and anxieties of the art of navigation. The writer well remembers such an experience on a run from St. Johns, Newfoundland to Nova Scotia, when a dense fog shut down on the little vessel two hours out of port and never lifted throughout the voyage. The sole means of navigation was the small shells, grains of sand and bits of gravel brought up from the ocean bottom by the Thompson Sounding Machine. Comparison of this material with an excellent chart of the ocean bottom, several hundred fathoms below, served to bring us snugly into the harbor of Sydney, Cape Breton. It is needless to say that the Thompson Sounding Machine was kept going throughout the greater part of the voyage of nearly 400 miles.

But if the navigation of the sea is difficult, that of the air is far more so. Fog is an even more baffling enemy to the navigator of the air than it is to his brother of the sea. There is no Thompson Sounding Machine for his guidance, even if he were able to plumb to the ocean's bottom.

Furthermore, should there be a combination of wind and fog, the problem for the air-man becomes utterly bewildering. A wind blowing from the north across the path of an air-man who is speeding east will of course carry him to the south. If his speed were, say, sixty miles an hour and the wind speed, as in the case of whole gale, were also sixty miles an hour, instead of his course lying east, it would lie southeast. In clear weather and by day he would be able to judge roughly the direction and speed of the wind by observing the direction in which the waves were running. But if he is enveloped in fog he has absolutely no means of determining either the direction or velocity of the wind, or indeed whether there is any wind at all.

In spite of the fact that dreadnoughts and destroyers of the United States Navy have been stationed at intervals of 50 miles, it must not be supposed that the task of flying across the Atlantic, even with all the resources of the Navy enlisted in the enterprise, is an absolutely simple and sure thing. If a day is selected for the flight in which there is a combination of light winds, absence of fog and generally clear weather, the problem resolves itself down to a question of motive power. If the liberty motors are capable of running continuously for 20 hours there is no reason why all three machines should not make the flight from Newfoundland to Azores without alighting. But if they meet with fog or winds blowing ahead or abeam, the actual distance that they will travel through the air, even if they hold a true course across the ocean, will be greater and the possibility of one or more of the engines giving out or of the oil supply running short will be increased. A forced landing on the water would involve some risk, especially in a wind and sea.

The Navy Department has announced that the navigator of these Navy planes will be assisted by several new navigational instruments which have been designed particularly for this kind of work. There is, for instance, the aerial sextant named after its inventor, Lieutenant-Commander H. L. Byrd, in which a bubble in a tube takes the place of the sea horizon, a substitution, the value of which will be appreciated at once by anyone who has done any air navigation. Often when flying at low altitudes the horizon is too dim to be clearly seen, and of course when one is above the clouds it is frequently impossible to see any horizon whatsoever.

The navigator will have with him also in his cockpit a projection chart of the Atlantic Ocean, which does away with much of the former mathematical calculations and enables the aviator to fix his position in a few minutes' time.

The most important aid among the new instruments is the drift indicator which is shown in the accompanying photograph of the cockpit of one of the great Navy seaplanes. Behind it is standing Lieutenant-Commander Byrd. The object of this instrument is to enable the navigator to calculate the speed and direction of the wind both by day and by night. The magnetic compass, of which each plane carries three—one in the navigator's cockpit and two in front of the pilot's cockpit—merely shows the course upon which the craft is heading. This would be sufficient in calm weather or if the winds were coming from dead ahead or dead astern of the ship; but if the wind is on the beam, the craft, even though she were pointing correctly on her course so far

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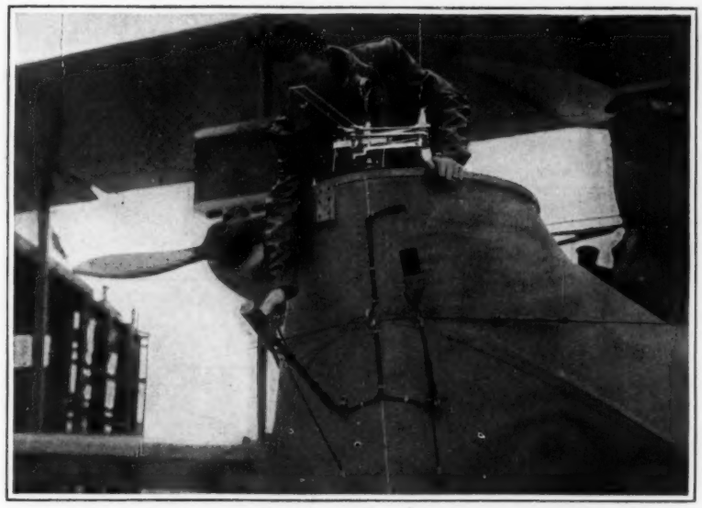
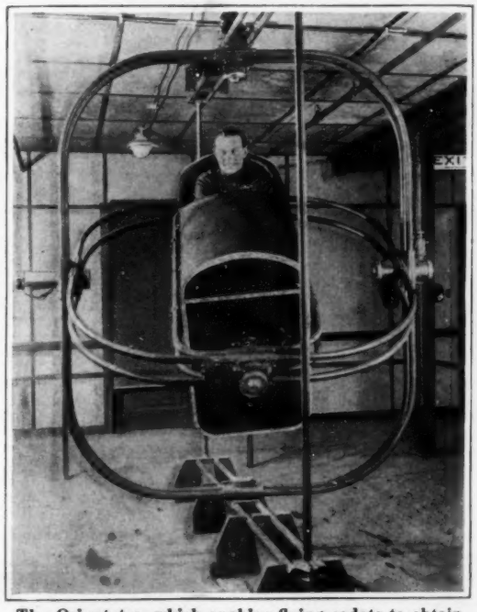


Cockpit of NC-1, showing on the rail the Drift Indicator, and below flares for landing



The Orientator, which enables flying cadets to obtain flying experience without danger

Gaining Flying Experience Without Leaving the Ground

WITHIN the past few months there has been perfected an apparatus whereby flying cadets may acquire flying experience without leaving the ground. The machine, known as the "Orientator," is the invention of William G. Ruggles of New York City, and serves to familiarize the beginner with the various loops, turns, nose dives, and so on experienced in trick or combat flying.

The "Orientator" is based on a modification of the old-fashioned universal joint, being composed of three concentric rings so pivoted together as to permit the fuselage member, which is pivoted within the innermost ring, to be put through every possible evolution experienced in actual flying. Thus the apparatus becomes practically an airplane as far as training is concerned. The cadet sits in the fuselage and by means of the joystick and rudder controls puts himself through practically all the evolutions which he is later to experience in the air.

Small, high speed electric geared motors, through high reduction gears to the various parts of the "Orientator," furnish the power for the evolutions. The joystick and rudder controls close the necessary contacts for the various motors. Because of the high-speed motors and great gear reduction, the action of the apparatus is prompt and positive.

An analysis of the "crash reports" from flying schools has shown that a remarkably large number are solely due to a failure to come out of the spinning nose dive or tight spiral. The only reason that the cadet has failed to come out of these maneuvers is that he has not yet become accustomed to these unusual movements. These evolutions stimulate the internal ears which send nerve impulses to the brain. The individual has no control over these impulses; the only thing he can do is to learn the significance of these impulses by experience. The problem is extremely simple. All that is needed is that every cadet should "fly" the "Orientator" day after day until he is entirely familiar with these new sensations. Any mistake that he makes causes him no harm, because he never leaves the ground. He is then prepared to undertake "stunting" in the air. Flying training on this ground training machine should be under the combined supervision of the officer in charge of flying and the flight surgeon.

A Substitute for Linseed Oil in Sweden

A SWEDISH engineer has succeeded in obtaining a substitute for linseed oil from purely Swedish raw materials, according to a report published in the *Journal* of the Swedish Chamber of Commerce in the United Kingdom. The substitute is said to possess all the good qualities of the genuine article. The invention, which is the result of long and patient work, has been bought and will be exploited by Director E. Schelin of Stockholm; manufacture would have been begun long ago, but for delay in delivering the necessary machines. The main advantage of the substitute oil is that it is cheap to manufacture and does not need an extensive plant, the cost of a factory capable of turning out 500 tons annually not being more than 20,000 crowns ($5,360 at normal exchange). The price of the manufactured article is very low compared with that of linseed oil.

A Bag Which Can Become an Emergency Life-Raft

INVENTED by a British corporal, the life-raft shown in the accompanying illustration is a most ingenious piece of equipment for aircraft which operate over water. As will be noted from the illustration, it consists of a more or less circular gas bag in the center of which is stretched a "floor" of heavy fabric. Ordinarily, the raft is carried by the airship in the deflated state; but in the event of accident it can be inflated in a few moments to form a most serviceable raft. The bag is really a series of bags, each being inflated through a separate air valve. Simple oar locks and a pair of oars are provided for propulsion purposes.

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Inflated life-raft, which is carried by British airships, in a deflated state

The Automatic Chemist

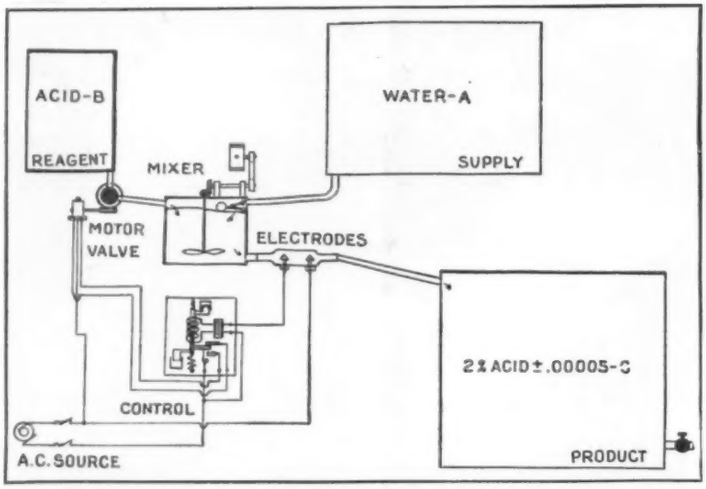
AT last the chemical machine! P. E. Edelman of New York has patented a system of automatic chemical control which does some routine control work better than a college trained expert can. Products subject to variations in process or from a variable source of supply can be continuously maintained at a desired standard by this new system. And it works.

Tons of acid which formerly varied over a wide range despite intermittent tests by the plant chemist are today constantly kept to close limits in pulp and paper mills by this invention. Dyestuff, soap, heavy chemical, brine electrolysis, and other works can also profitably use this automatic control chemist.

In the case here shown by way of example it is desired to produce a 2 per cent sulfuric acid mixture from variable sources of supply. Instead of having a chemist make his determination and set the valves by hand, intermittently, electrodes are used, associated with compensated electrical control-circuits which overcome obvious difficulties, to make instantly the proper adjustment as needed to keep the material to a standard. The apparatus is operated by the fluctuations of the material itself. By referring to the drawing it will be seen that any variation in the product will itself operate contacts suitably retarded against transient effects to control automatically the cause of the change and restore the normal condition. In the instance illustrated, if the acid solution becomes too strong the electrically operated valve shuts off a corresponding portion of the reagent supply; or, vice versa, in case the resultant becomes even slightly too weak. Acid-proof electrodes inserted in the material to be controlled are provided with temperature compensation and thermic control where necessary. The only remaining factor to alter the conductivity between the electrodes is the chemical content. As shown by Kolrausch and others the conductivity varies over almost a straight line curve within limits for many weak solutions. Other cases have different relations of conductivity to composition, the effects being particularly marked at end points, brine saturation, etc.

An interesting application under development is the oil floatation process where definite percentages of oil and acidity of carrying liquid are to be controlled according to variable supplies. In many other plants the automatic system can be used to advantage. Once a qualitative analysis is made and the variable factors determined the control can be accomplished automatically. Chemical accidents such as the escape of SO_3, or halogens due to uncontrolled or congested processes are obviated by the automatic system and an alarm may be provided to warn of such unforeseen troubles.

The automatic chemist is an assistant and aid to the trained chemist because it relieves him of routine control work and permits delivery of standard products at less cost than by non-automatic methods.

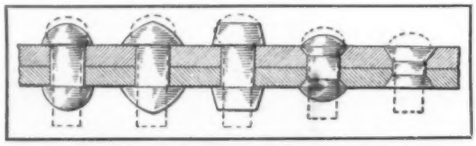


The automatic governor for chemical reactions, which regulates exactly the proportions of a mixture

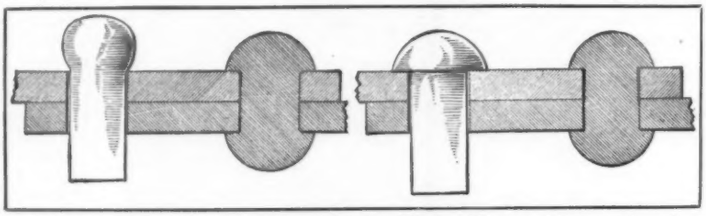
New Styles in Rivets

IN speeding up our industrial machinery to the point where it would supplement most effectively the efforts of our military to *straf* the Hun, there was no detail too small for the attention of our engineers. Even such an apparently trivial consideration as the best shape for a rivet got its share of careful discussion. To the layman it might seem that a rivet which is going to be heated red hot and then pounded into place might equally and indifferently be any shape at all, that the process of heating and pounding would make it fill the hole. But this is not the fact.

The ordinary rivet has a finished head on one end, and is headed only on the other after going into the hole.



The rivet with unfinished head simplifies store-keeping



Showing how a prepared rivet head (right) fails to fill hole, while one shaped by the riveter (left) is an airtight fit

The flow of metal from this second end fills that side of the hole all right enough; but on the side of the prepared head, from which there is no flow of metal, there is a tendency for the hole to remain not quite filled, as indicated in our cut. So the efficiency men who had responsibility for the production of our shipyards proceeded to design a rivet which would fill its hole completely under the gentle ministrations of the machine. The result is a rivet which has, on its prepared upper end, only enough of a head to prevent it from falling through the hole and out the other side. When this is inserted and the riveting gun put into action against it, there is a flow of metal from both ends of the rivet into both ends of the hole, and the hole is accordingly filled tight.

Heretofore, in large constructional work, it has been necessary to ream the rivet holes so as to have a perfect fit for the rivet. With the bulb-head rivets such precautions will not be necessary because the rivet will be made to fit perfectly by the pounding of the riveting gun.

Another interesting development in riveting science is seen as a natural consequence of this. Rivets on the finished article must show heads of various styles and sizes; so under the old system it was necessary to carry in stock a variety of rivets. Now, however, the only thing the stockkeeper has to keep track of in rivets is the size of the shank; for with the head formed during the process of driving the rivet, the single shape illustrated takes care of all demands.

A Megaphone of Novel Design

By F. R. Watson
Professor of Experimental Physics, University of Illinois

THE megaphone in common use is cone-shaped and concentrates sound along its axis, so that it is well suited for directing sound to a distant object such as, for instance, a sailor in the rigging of a ship or a small boat on the water. It is at a disadvantage when addressing a crowd of people because only those along the axis can hear distinctly what is said. The megaphone pictured in Fig. 1 remedies this fault. The rectangular aperture has a directing action such that, when held with the longer dimension vertical, it spreads the emerging sound out sideways, but not up and down. The result is that the sound is confined in a horizontal, fan-shaped bundle.

At first thought, people think that it would be more effective to place the long dimension of the aperture horizontal since this position appears to allow a better chance for the sound to go sideways. This incorrect position was observed by the writer in one of our large passenger depots. It would not serve the purpose because the sound would then be directed up and down and prevented from passing sideways as intended.

The directive action is due to the diffraction of sound according to which sound waves emerging through a narrow opening spread out in a circular path with the opening as a center. When emerging from a wide opening, they proceed with practically no sidewise spreading. Fig. 3 shows these effects where the water waves generated by puffs of air at the center of a brass ring pass to the boundary and emerge through the narrow slit as circular waves proceed with little change through the larger opening.

For practical applications, the megaphone can be used to address a crowd of people on bleachers, to spread the sound from a phonograph, or generally, whenever it is desired to direct sound into a fan-shaped bundle.

The megaphone may be used also as a directive *receiver* of sound; its action in this case being just the opposite to that just described. Any sound generated in the fan-shaped region will be received and made manifest to the ear

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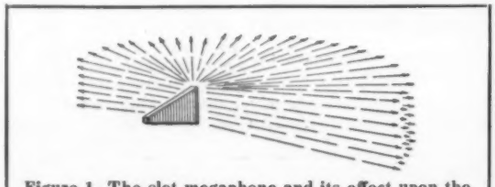

Figure 1. The slot megaphone and its effect upon the radiated sound waves

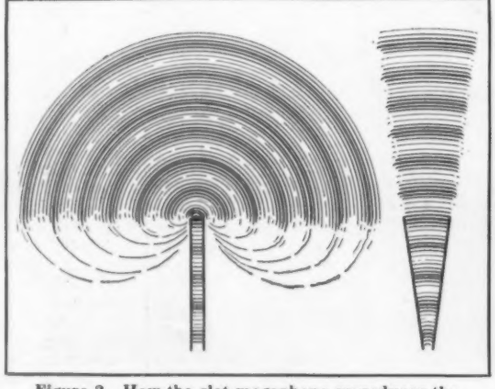

Figure 2. How the slot megaphone reproduces the action of the water waves of Fig. 3

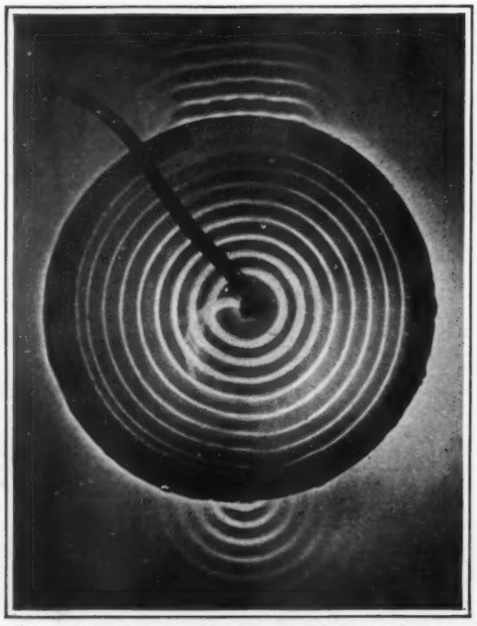

Figure 3. The waves created inside this brass ring pass through the large opening above unaltered in form

Our Trans-Atlantic Dirigible Entry

Some Constructional Details of the U. S. Navy Dirigible C-5

WHILE it was to be expected that the heavier-than-air craft would not have things entirely their way in the matter of the trans-Atlantic flight contest, the contemplated entry of the U. S. Navy dirigible C-5 is one of the greatest surprises in aeronautical circles to date. Airmen had been looking forward to the entry of one of the large British dirigibles, but little thought had been given to the possibilities of the smaller dirigibles of the so-called Blimp class.

With the successful consummation of the first leg of the great flight, namely, the journey between Montauk Point, at the extreme easterly end of Long Island, and St. John's, Newfoundland, the dirigible C-5 is apparently well qualified for the trans-Atlantic crossing. Perhaps before this reaches the reader the dirigible will have made the flight; at any rate, the present plans call for a non-stop flight between Newfoundland and the English coast. It is reported that three battleships are already stationed along this route, the "Utah" 500 miles out, the "Florida" 600 miles beyond the "Utah," and the "Arkansas" about 300 miles from the west coast of Ireland. If the seaplanes complete the Trepassey-Azores leg of their flight, the destroyers on this route will be moved to the north and stationed along the C-5 route. However, it may be that the dirigible will not wait for the positioning of the destroyers along its route, if weather conditions favor an immediate start.

The C-5 is one of a number of twin-engined dirigibles of that class, measuring about 192 feet in length. In fact, the Navy first engaged in serious airship work in 1917, before our entrance into the war, by constructing 16 small dirigibles of the single-engined Blimp type. These were designed from a picture on the back of a post card that was smuggled out of England, and from an account by a returned traveler who had seen something in England that he tried to describe. The Government already had information that the English were working on a certain small airship for a submarine scout, and that the type was useful. The dirigible was practically a gas bag equipped with an airplane fuselage; and from its meager information the Navy set to work designing and building our Blimps, which, when a comparison became possible with the British ones, proved to be very much the same.

The early Navy Blimps measure 164 feet in length and have a gas capacity of 84,000 cubic feet. A single Curtiss engine is employed, rated at 100 horse-power The speed is given as 45 miles an hour, and the range at full speed as 500 miles. They are not remarkable for any great performance, although they have trained 150 pilots for us in the time we have had them working, and have done about 4,000 hours of patrolling, covering in all some 140,000 miles.

These ships have been doing regular submarine patrol work along Atlantic coastal waters throughout our period in the war, and have acted as convoys for whole fleets of merchant ships. They have really been useful for that limited function. However, as Commander J. C. Hunsaker of the Bureau of Construction and Repair, Navy Department, recently pointed out, they cannot go very far to sea because they have only one engine. Indeed, there is one case on record where a few lads in one of them got caught out at sea and in a helpless condition drifted for two or three days and came down at Halifax. Their being saved was more good luck than management; hence the U. S. Navy decided that two-engined dirigibles were needed, and the next type of dirigible was designed and constructed.

So we come to the C class of Navy dirigible, most of which are equipped with two Hispano-Suiza engines. This design has nearly twice the gas capacity of the first model, and the speed has been pushed up above 60 miles an hour, the radius being about the same. The ships with the twin-engines are still fairly new, but the first one of the series has flown from Akron to Washington, then to Rockaway, and more recently from Rockaway to Key West. The longest flight of this class, prior to the present C-5 cruise, was 30 hours. In all, the Navy is building 15 of the C class of dirigibles.

The C-5 is provided with a hull or body 40 feet long, and suspended about 18 feet below the gas bag. Ensign E. O. Campbell, the directional pilot, occupies the coxswain's seat in the bow of the body. His duty is to keep the ship on its path and steer in a horizontal plane. Lieut. J. B. Lawrence occupies the pilot's seat beside the commander, Lieut-Commander E. W. Coil, and the two of them navigate and change the elevations of the balloon in order to take advantage of favorable winds. The engineer's station is in a cockpit in the body's turtleback, just aft of the pilots. Between the gas tanks and the extreme aft is the radio operator, Ensign M. H. Esterley. All parts of the ship, including the twin engines, can be reached by means of communicating gangways.

The principal feature of the C-5 is the surprisingly low consumption of its twin engines, which are of the Union type instead of the usual Hispano-Suiza. Each engine develops about 120 horse-power, instead of 150 as in the V-type Hispano-Suiza engine. The Union engine in this case is of the six-cylinder, vertical design.

As regards the fuel question, there is a certain amount of mystery. According to available information the petrol tanks are said to carry 250 gallons, and the engines consume about 10 gallons per hour when running on full throttle. It is estimated that the C-5 is thus able to travel some 1,250 miles in still air at high speed, and considerably farther if backed by

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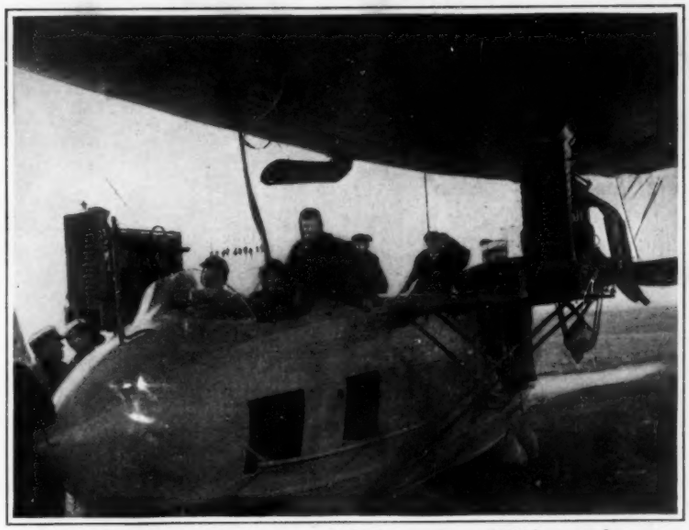
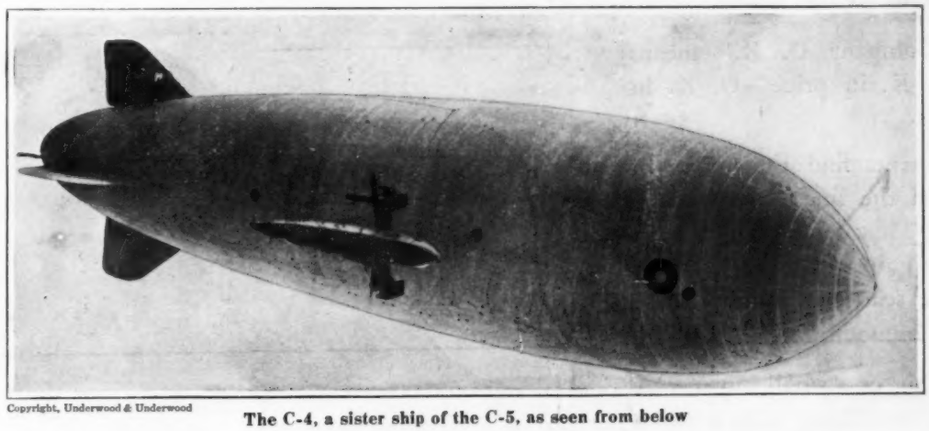


Gondola of the C-5, showing twin Union engines of 120 h. p. each



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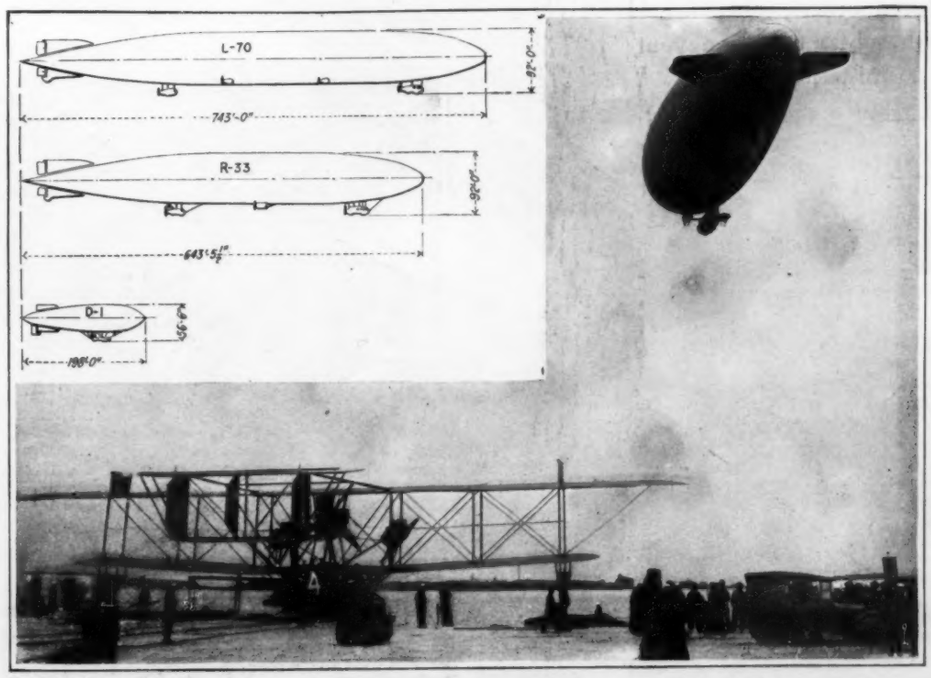
The C-4, a sister ship of the C-5, as seen from below



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Actual comparison between a Navy NC boat and a C-type dirigible, and a diagrammatic comparison between one of our small dirigibles and the German L-70 and the British R-33

THE FAIRBANKS COMPANY O.K.

—*what it means to Purchasing Departments of American Industries*

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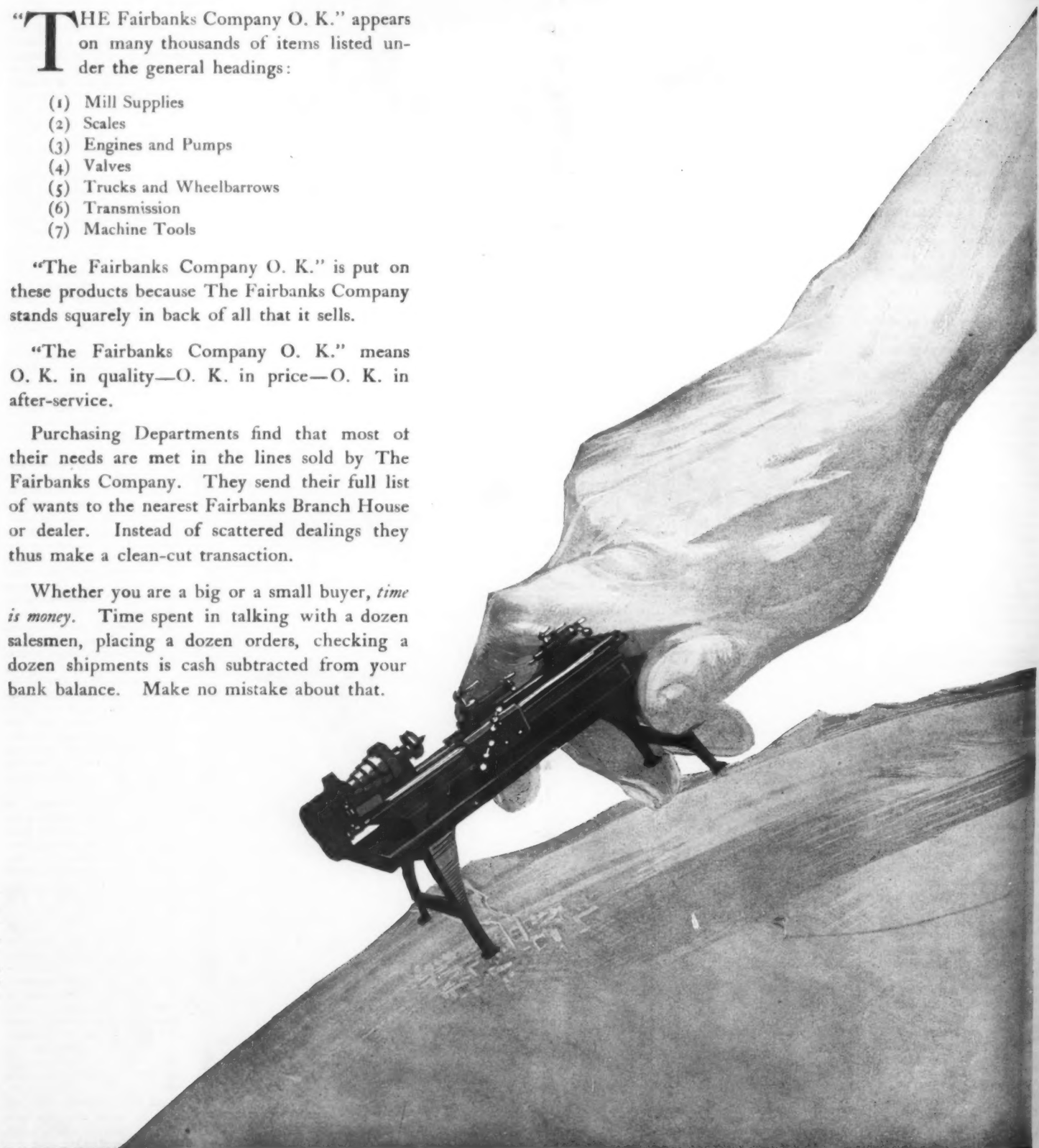
(7) Machine Tools

"The Fairbanks Company O. K." is put on these products because The Fairbanks Company stands squarely in back of all that it sells.

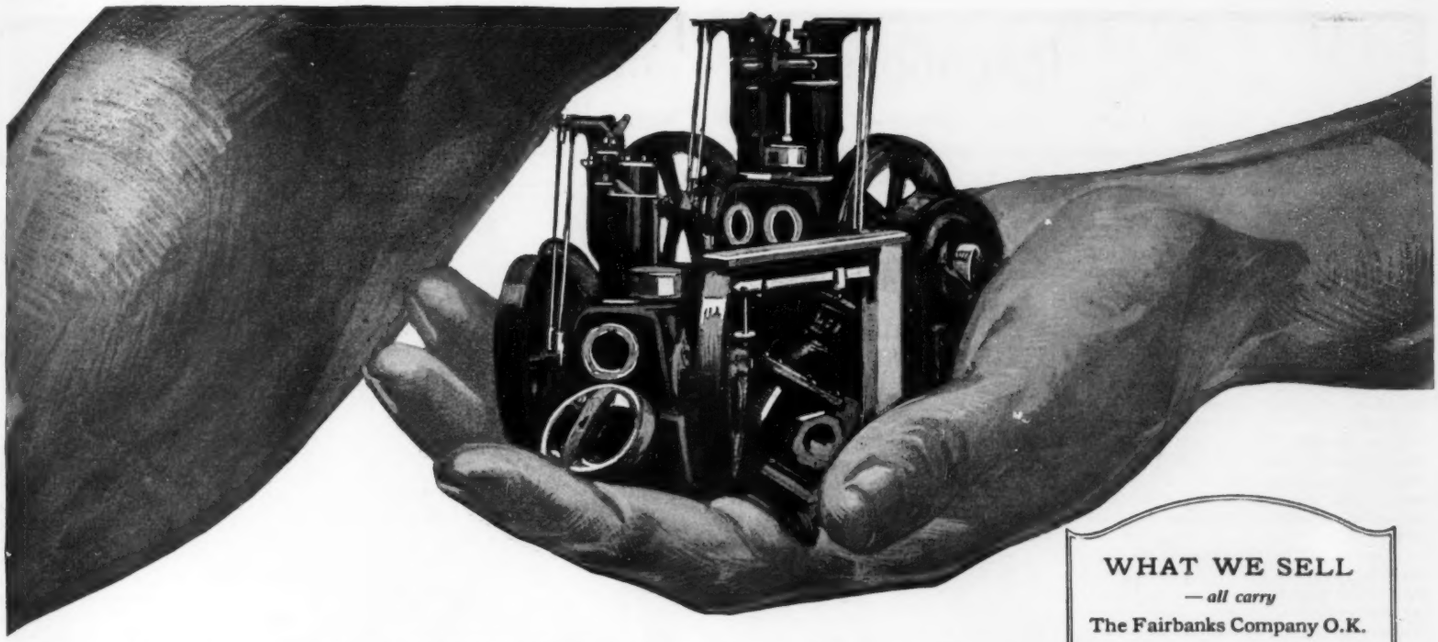
"The Fairbanks Company O. K." means O. K. in quality—O. K. in price—O. K. in after-service.

Purchasing Departments find that most of their needs are met in the lines sold by The Fairbanks Company. They send their full list of wants to the nearest Fairbanks Branch House or dealer. Instead of scattered dealings they thus make a clean-cut transaction.

Whether you are a big or a small buyer, *time is money*. Time spent in talking with a dozen salesmen, placing a dozen orders, checking a dozen shipments is cash subtracted from your bank balance. Make no mistake about that.



MILL SUPPLIES ❧ SCALES ❧ VALVES ❧ MACHINE TOOLS ❧ TRANSMISSION



The Fairbanks Company stocks its Branch Houses to meet most of the mechanical-equipmennt needs of mills, factories, mines, railroads and steamship lines.

Whether wrench, valve, scale, saw, transmission, engine, pump or any of the other items sold by The Fairbanks Company, you are assured high quality and a fair price when you see "The Fairbanks Company O. K."

We invite you to telephone or to call on the nearest Fairbanks Branch House.

THE FAIRBANKS COMPANY

ADMINISTRATIVE OFFICES: NEW YORK

Branch Houses

Albany		Detroit	Newark	Paterson	Pittsburgh	Syracuse
Baltimore	Bridgeport	Hartford	New Orleans	Philadelphia	Scranton	Utica
Boston	Buffalo	Kansas City	New York	Providence	St. Louis	Washington
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WHAT WE SELL

— all carry

The Fairbanks Company O.K.

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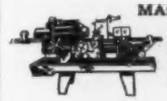
The lines are complete. Every item is the pick of its class.

TRUCKS and WHEELBARROWS

All types, sizes, for every use—all bear "The Fairbanks Company O. K."



MACHINE TOOLS

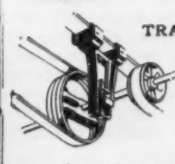
All leaders in their lines. Sold under "The Fairbanks Company O.K."

SCALES

The famous Fairbanks Scales—the scales that do the world's weighing.

VALVES

All types—all sizes—all bear "The Fairbanks Company O. K."



TRANSMISSION

Everything you need from leather belting to the little 3" pulley.

ENGINES and PUMPS

Engines—gasoline, kerosene and oil; and new type Super-Diesel.

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O.K.

TRUCKS & WHEELBARROWS ENGINES & PUMPS

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

A Suit of Armor for the Tire

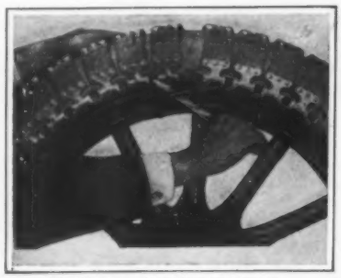
THERE is a certain type of inventor who is never satisfied that the current way of doing anything is the best, and who is continually devising what appeals to him as new and improved ways of meeting old and familiar problems. And one of the most fertile fields for such a man has always been that offered by the pneumatic tire. For tires will wear out, in spite of everything that we can do about it; and the problem of the traffic man is to make them wear as long as possible. Then, too, tires will slip, especially when we put them on heavy automotive vehicles; so in the same breath the traffic man is called upon to produce a tire that will wear and that won't slip.

Of course, within the limits of the rubber tire, it can't be done; the non-slipping feature has to be incorporated from without, in the shape of chains or other tackle of some sort. On the whole, we believe that the chain, of standard type, has been found about as satisfactory as any other means of eliminating skidding; but occasionally one of the chronically dissatisfied inventors comes along with something that is at least good enough to prevent us from dismissing it with a laugh or a shrug of the shoulders or a significant tapping of our collective forehead.

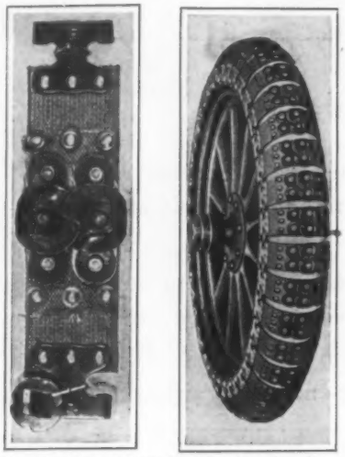
We illustrate the latest thing of this sort to come under our observation. It is really what our title implies—and not merely armor, but chain armor as well; for it is flexible, and is wrapped around the tire much as a medieval warrior might have wrapped a shirt of mail about his anatomy—if that is the way in which medieval iron shirts were put on.

This armor, in the present case, is made up of rectangular sections of the toughest kind of fabric, bearing a series of circular iron plates, as illustrated. Each of these sections is hitched to its neighbor by means of the little square-round link, shown, in our lower left-hand cut, wired to the end of the section for shipment. It will be realized that when two adjoining sections are hooked together with one of these at each side, and then subjected to a strain that tends to pull them apart, they cannot yield to that strain—without breaking the link. The whole chain of sections is thus put together, and wrapped about the tire; and the final joint is made with a little tool, as shown in the upper one of our three pictures. Then the tire looks as at the lower right; it is given a surface that makes skidding unlikely, to say the least.

The conspicuous advantage of this outfit is that when, as happens to every anti-skid device sooner or later, one of the sections gets worn out smooth, it can be removed and replaced without any effect upon the rest of the protector, and without any cost except that of a new section. Then the tightening links by means of which the thing is clamped on the tire make it possible to put the protector on or take it off without deflating the tire, and at the same time to keep the protector tight under all conditions. Finally, made in sections as it is, it expels mud, water, sand and gravel through the openings between the sections and so keeps itself and the casing comparatively clean and dry; but while doing this, it covers enough of the tire surface to constitute excellent protection against puncture and blow-out and other hazards.



Putting on the tire protector



Sectional protector for the tire showing a single unit and assembled protector

Picking Up a Hot Handful

THE laboratory worker is frequently confronted with a situation in which he has to handle with his hands a tube or retort containing a boiling liquid. Naturally this is not to be done without precautions of some sort; but the precaution ordinarily employed is usually a makeshift of some sort. A scrap of waste, the corner of an apron, or some other fragment is allowed to act as buffer between the hot glass and the flesh. Our Parisian contemporary, *La Nature*, illustrates a very handy little device intended to replace this more or less unsatisfactory agency by one expressly designed for the purpose in question. The picture is self-explanatory; and it is obvious that these little finger-stalls of rubber are less conductive of heat, less liable to leave a portion of the finger unprotected, and altogether more workable than the hit-or-miss methods which the chemist employs every day to insulate his fingers from heat. In particular, they give him an instantaneous and firm grip on the article which he is handling, which is more than can be said for an old rag that has been knocking about the laboratory for an indeterminate period; and they give him a degree of direct and immediate control over the vessel which he cannot hope to attain in the use of tongs or screw-jaws of metal.

A French suggestion for handling hot mixtures in the laboratory

Heating Water by Means of Electrolysis

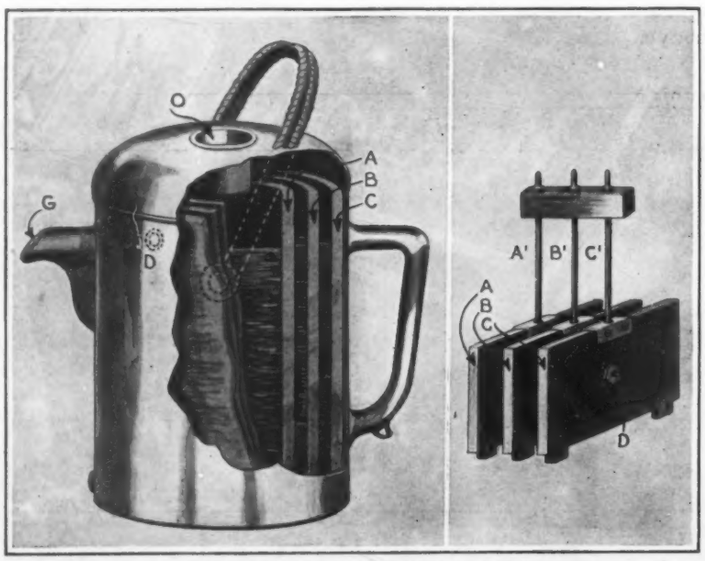
THE heating of water by electrical methods has hitherto been attended with no great measure of commercial success, partly because the apparatus has been too cumbersome and complicated, according to a German electrical engineer. And to prove his assertions he has devised two ingenious systems of heating or boiling any required amount of water. In neither case is any special heating element required; the water itself forms the electrolyte. Briefly, the apparatus consists of two or more plates or cylinders, which are suitably arranged beside one another and form the electrodes.

The simpler form of heating apparatus is shown at the right of the accompanying engraving. Three carbon plates, *A B C* are used, about eight inches square, arranged in parallel to one another at a distance of 0.4 inch or 0.6 inch, and connected together by an insulated bolt *D*. The plates are also separated by insulating rollers. The rods *A' B' C'* serve for introducing the current. The apparatus is intended for three-phase alternating current, and can be regulated by cutting off one of the three phases. The apparatus is dipped into the water which is to be boiled, and can be used on any voltage or with any current. The carbons will last for an indefinite time, and as no heating element is required, consisting of coils and the like, repairs are likely to be negligible. The apparatus is always ready for use and is quite as efficient as anything else on the market for a similar purpose, according to its German inventor.

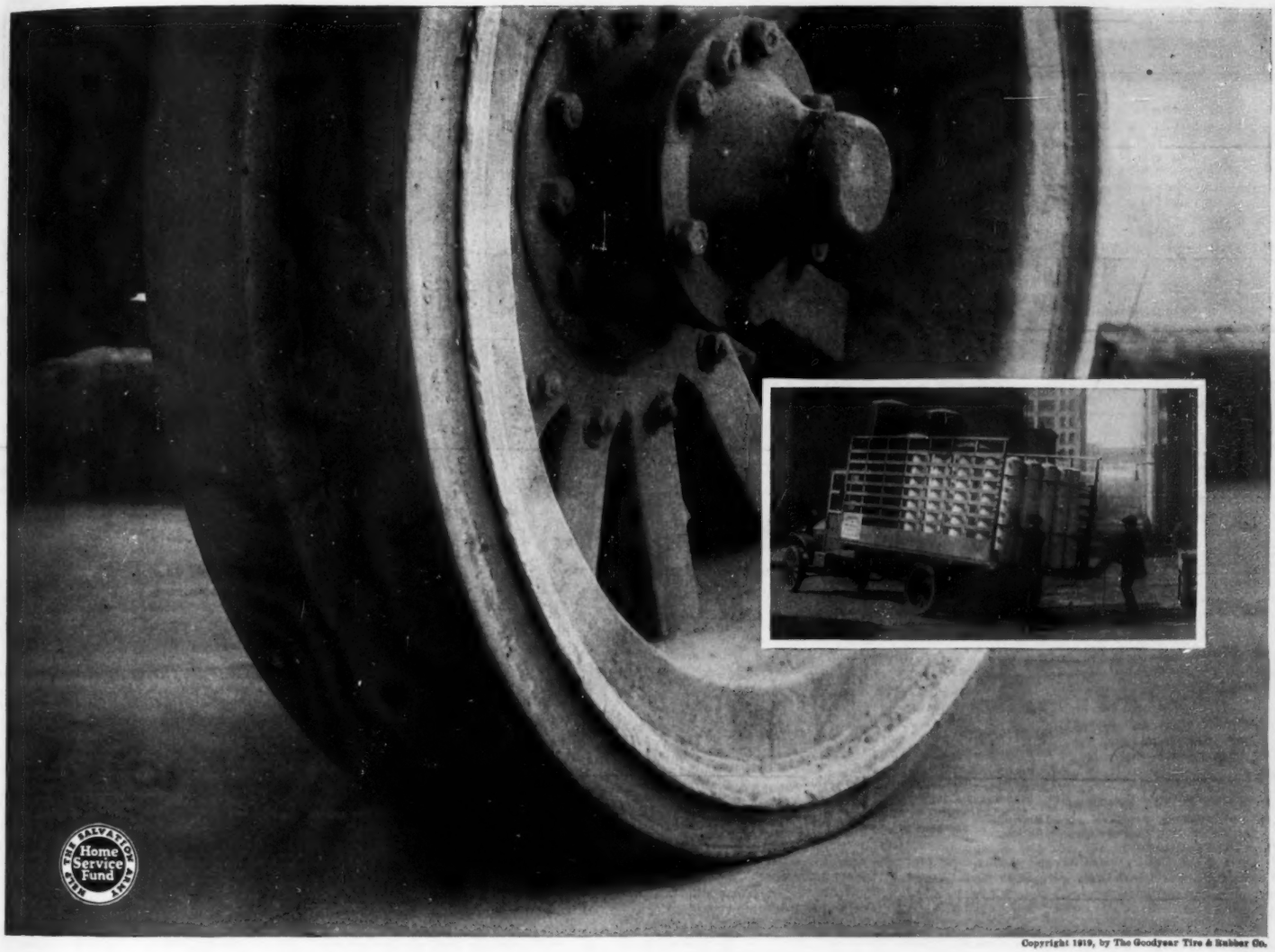
It is said that carbon is the only substance that can be used for the plates, because metallic plates soon disintegrate and oxidize. Zinc plates become covered with oxide and carbonate; copper, tin, iron and nickel are equally unsuitable. Tests have shown that with this method it requires an hour to heat 70 gallons of water to the temperature suitable for a bath. The current required on 220 volts is 20 amperes, and this gradually rises to 34 amperes. If one of the plates is cut out, it is possible to keep the water for any length of time at any given temperature. The full temperature is reached with the three plates; with two neighboring plates the current falls by about 50 per cent, and with the two end plates it sinks still further to about 30 per cent of the initial value. The apparatus is intended to heat fluids which must be conductive, and is specially suitable for heating baths in houses. The tests were conducted in winter when the conditions were unfavorable; in summer there is less loss from radiation. If 20 or 30 amperes are not available smaller plates can be used, or the plates can be separated by greater distances; but in such cases the heating requires longer time.

The other system is shown at the left. In this case the water is instantly heated in the can and allowed to flow out.

(Continued on page 560)



Two systems of heating water by electrolysis, which have recently been worked out in Germany



Copyright 1919, by The Goodyear Tire & Rubber Co.

"FIVE Goodyear Solid Tires, which have passed the 50,000-mile mark on one of our trucks, undoubtedly will last another year and give us a total of 75,000 miles of continuous service. Their treads are still 1½ inches thick. Due to an accident, the sixth tire in the set had to be removed at 50,000 miles; otherwise it, too, unquestionably would be delivering like the other five today. Our experience with Goodyear Solid Tires makes it easy for us to realize why so many truck owners specify Goodyears."—J. J. Callahan, Local Manager, John Wood Manufacturing Company, Brooklyn, New York.

Thus far a total of 300,000 miles of service have been delivered by the set of six Goodyear Solid Tires described above.

Yet it is apparent that even this extraordinary figure will be increased because the present condition of five of these tires indicates that each will run 75,000 miles—the sixth having been injured as the result of a collision.

When the un-retouched photograph above was taken, all five Goodyear Solid Tires had traveled 50,000 miles and still all were as smooth and thick with rubber as the two shown here.

Although these Goodyear Solid Tires have consistently carried heavy loads of boilers and tanks over cobblestone pavements and into plumbers' scrap-strewn storage yards, they offer little evidence of having done so much hard work.

Certainly the appearance of the veterans affords visual proof of their freedom from chipping and shredding, a feature broadly noted in Goodyear Solid Tires.

While the mileage given here is unusual, it is well to observe that it has been equaled and even surpassed by other users of these stalwarts.

Their reports of high average scores plainly show what Goodyear Solid Tires plus intelligent care can do, and thus draw important attention to the effectiveness of Goodyear methods of solid tire manufacture.

THE GOODYEAR TIRE & RUBBER COMPANY, AKRON, OHIO

GOODYEAR
AKRON

Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Pertaining to Aeronautics

POISONOUS VAPOR GENERATOR FOR AIRPLANES.—G. H. GLOVER, Short Hills, N. J. The invention relates to attachments for airplanes whereby poisonous vapors may be generated in such a way that they will not affect persons occupying the airplane, while leaving behind a poisonous atmosphere. An object is to provide a device which can be easily controlled by the pilot and is adapted to utilize the air current created by the speed of the machine in flight.

AIRPLANE.—G. T. BUCHANAN, Sinnsboro, S. C. An object of the invention is to provide a bracing arrangement for an airplane which involve the construction of a plurality of relatively narrow airplane wings on each side of the body, these wings being separate so as to reduce the likelihood of the total destruction of the wing structure on one or the other side by a well directed shot in combat.

AIRPLANE.—O. W. BOTEA, Barre, Vt. Among the principal objects which the invention has in view are, to increase the propelling feature of the driving mechanism with which the airplane is provided, to increase the levitation, to regulate the flight, and to check the flight of the airplane.

Pertaining to Apparel

DETACHABLE FUR COLLAR FOR COATS.—A. H. SHERWIN, care A. Sherwin & Bros., 715 Broadway, New York, N. Y. The invention relates to wearing apparel and more particularly to coats, its object is to provide a fur collar which can be readily placed in position on the regulari and permanent cloth collar of a coat or removed therefrom, whenever it is desired by the wearer. Another object is to permit the use of the fur collar on various styles of permanent coat collars.

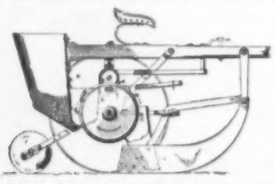
Electrical Devices

ELECTRICAL WATER HEATER.—J. C. FELDMAN, 1500 Times Bldg., New York, N. Y. The invention relates to automatic electric heaters. Among the objects is to provide a structure of relatively small dimensions, easily transported in one's grip, for easy attachment to any convenient electric plug or socket. A further object is to provide a switch whereby the heating current will be completed automatically with the simple movement of the delivery valve to open position for hot fluid, but which is inoperative when the same valve is turned in the opposite direction to deliver cold fluid.

TROLLEY HARP.—A. J. EDWARDS, 3509 22d St., Washington, D. C. The invention relates particularly to the construction of the harp, the manner in which the trolley wheel is supported thereby, and is normally allowed full flexing movement with respect to the harp and resiliently maintained in connection with a trolley wire, and is locked immovably in connection with the harp when the controlling cable or wire of the trolley pole is manipulated to lower the latter, or manually shift the same in locating the trolley wire.

Of Interest to Farmers

POTATO PLANTER.—F. F. MENDENHALL, Kilgore, Neb. The invention has for its object to provide a planter wherein the cuts are taken from a hopper in succession and delivered one by one into a dropper chute, and wherein a furrow opener is provided for opening a furrow to receive the



LONGITUDINAL SECTION THROUGH THE PLANTER

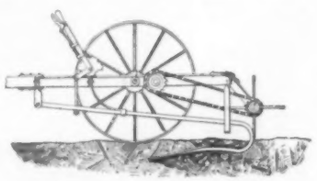
cuts, and covering mechanism for covering the cuts after they have been dropped, and other mechanism for simultaneously lifting the furrow opener and covering mechanism, and disconnecting the dropping device from its operating mechanism.

REVERSIBLE TRACTOR PLOW.—R. TINKER, Little York, Ill. The object of this invention is to provide a reversible tractor plow having two frames each mounted on traction wheels, the frames being pivoted together so that either frame may be moved relatively to the other for steering purposes, means being provided for rotating the traction wheels on both frames simultaneously and for raising and lowering the plowshares.

PLOW.—S. A. WARE, Tignall, Ga. The invention has for its object to provide means in connection with plow points of every character, for permitting wear to be compensated for, that is for permitting the point to be lengthened, when worn away to its original dimensions, the point having a longitudinally extending slot near its upper end for receiving a securing means to connect the plate to the standard.

SPRAYER.—J. T. PLUMER, North End Station, Detroit, Mich. An object of the invention is to provide a spraying apparatus which is adapted to be adjusted to suit various widths of rows of plants, and which is provided with a jet of very simple form to control with facility the discharge of the water from the outlet orifices in the spraying arms or to entirely cut off the flow.

PLOW.—F. MANNING, Geneseo, Kan. The general objects of the invention are to provide a plow so formed as to effectively shed the turned ground and to provide a revolving clearer so



A LONGITUDINAL VERTICAL SECTION

formed and so arranged relatively to the plow as to maintain the latter clear of weeds and trash the action of the plow and clearer to be such as to cause the trash to be deposited on the surface of the ground and uncovered to form a mulch.

Of General Interest

POWDER PUFF.—B. H. KARMEN, care Velvatone Powder Puff Co., 140 Sixth Ave., New York, N. Y. A specific object of the invention is the employment of a suitable member, such as a ring, dish or plate of cardboard, which lies within the upper shell of the powder-puff body and between which and the said shell the ribbon is clamped with the edges turned back under the edges of the member and held by the upsetting of the flange which carries the pile cloth, thus doing away with the gluing of the handle-forming ribbon.

WALL CONSTRUCTION.—A. HARDONCOURT, JR., 8539 106th St., Richmond Hill, L. I., N. Y. The invention relates to wall construction for channel brick, particularly intended to enable a channel brick type of wall to be laid up at corners. The vital point of the invention is that channel brick are so combined at a corner where ordinarily the open ends would be exposed, to be bonded with a header having plain sides and ends, such header partly overlapping and bonding the channel brick in adjacent rows or courses and simultaneously closing the openings.

PAPER ROLL RACK.—F. and F. T. WINTERHALTER, 308 Chapple Ave., Jersey City, N. J. An object of the invention is to provide a simple, strong and efficient paper-roll rack which will always present a portion of the paper from the roll ahead of the cutting knife, thus obviating the necessity for manipulating the roll of paper when paper is to be drawn from the roll; the device is provided with locking means for the paper guide operable by the cutting member.

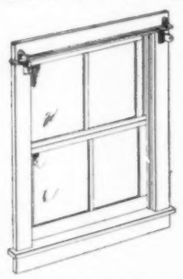
DENSITY METER.—C. N. SOWDEN, Santa Clara, Central Caracas, Cuba. The invention relates to a density meter through which liquid, the denaity of which is to be measured, may flow continuously. The object of the invention is to provide a simple and efficient meter; any variation in the density of the liquid passing through the device is shown by indicators.

CLEANING DEVICE.—E. H. HARRY, Box 322, Gibson City, Ill. The invention has for its object to provide a device for removing stones, gravel, sand, dirt and the like from beans and other similar vegetables. The device comprises an inclined trough, a feed hopper, a separating tank, and means for supplying water. As the beans pass from the hopper, streams of water play upon them and they are thoroughly washed.

SAFETY CATCH FOR BROOCHES.—C. J. KRAFT, 23 N. Center St., Pottsville, Pa. The general object of the invention is to provide a catch by which the pin will be positively locked in the fastened position through the medium of a manually operated lever latch associated with the catch forming a closure for the latter after the entrance of the pin therein.

PARCEL HANDLE.—C. SCHNEIDER, 529 W. 125th St., New York, N. Y. The invention relates to detachable parcel handles such as are commonly used for handling or carrying packages bundles, boxes or the like wrapped with cord, or its equivalent. The prime object of the invention is to provide a strong, comfortable and reliable handle at a minimum cost.

CURTAIN SUPPORTING BRACKETS.—C. M. PRIMM, Long Beach, Cal. The invention has for its object to provide a device capable of quick and easy attachment to any casement



PERSPECTIVE VIEW SHOWING THE SUPPORT IN USE

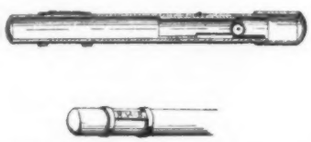
without marring the same, and without the necessity for nails, screws or the like, and wherein means is provided for supporting a blind as well as the curtain, the curtain supporting means being adjustable.

CONTAINER LABEL AND GUARD.—W. H. MERKLEE and J. H. GARAGHTY, address J. H. Garaghty, 27 Ridgefield Ave., Bogota, N. J. Among the objects of the invention is to provide a combined label and guard which may be connected with the bottle by adhesive or through clamping means in such a manner as to be retained on the bottle, box, or container or the like and in such a position as to be engaged by a hand grasping the bottle, an opening is provided so as to disclose the usual label on the bottle.

FLUSHING APPARATUS.—F. SCHUH, 432 Rutherford Ave., Trenton, N. J. The object of this invention is to provide an apparatus arranged to insure proper employing of a water closet or sink tank, for flushing purposes through a siphoning action of the contents of the receptacle and a subsequent refilling with water. Another object is to dispense with the numerous metallic fixtures liable to corrode and now generally employed, thus insuring a longer life to the tank.

PROCESS OF PRODUCING LEGENDS IN BLACK ON MOTION PICTURE NEGATIVES.—G. LANE, Box 358 Fort Lee, N. J. The invention relates to motion picture photographs, and has particular reference to the process of producing legends, titles, inscriptions, or the like, on motion picture films in a manner that is most expeditious, and cheap and which, moreover is capable of the best possible illustrative results.

CHECK PROTECTOR.—R. W. BRANSON, 238 Railway Exchange Bldg., Kansas City, Mo. The invention has for its object to provide a pocket device of the character specified by means of which the monogram of the drawer of the check



SECTION SHOWING PARTS IN WITHDRAWN POSITION, AND VIEW OF MONOGRAM

may be embossed on the check and inked to provide a distinctive mark. The device comprises a case carrying a toothed roller and an ink pad over which the roller moves when extended beyond the casing.

CONTAINER.—D. GUARDINO, 104 Harrison Ave., Brooklyn, N. Y. The object of the invention is to provide a container of paper or similar sheet material and more especially designed for containing charlotte russe, ice cream or other confections. Another object is to provide a container made from a single piece or blank of flat material to allow convenient shipping and storage. The blank is so constructed that it may be quickly formed into a container.

FLUSH TANK VALVE.—F. J. DOWLING 425 W. 124th St., New York, N. Y. The invention relates to plumbers' fittings, and has particular reference to valves for flush tanks with a view to making them non-leakable. Among the specific objects are to provide an automatic valve structure comprising what may be called a wedge seat and a movable valve member cooperating therewith and having a complemental seat groove adapted to contact on both sides or surfaces of the wedge seat.

COMPOSITION OF MATTER FOR TEMPERING STEEL.—E. A. HALSETH, Clearbrook, Minn. The object of the invention is to provide a composition whereby steel can be hardened without danger of cracking the steel or warping the article in tempering. The composition consists of the following ingredients in substantially the following proportions: Alum, 3 pounds; ammonium chlorid, ¼ pound; vinegar, ½ gallon; oil, ½ gallon; lemon juice from about ½ dozen lemons, mixed with 5 gallons of water.

PNEUMATIC TRIGGER PULL FOR FIREARMS.—A. BOYNTON, 1800 San Pedro Ave., San Antonio, Texas. An object of the invention is to provide a pneumatically actuated mechanism for operating the trigger or other projectile discharging apparatus of a firearm, which enables an internal application of the operating force, thus preserving the equilibrium of the firearm irrespective of how suddenly the operating force is applied, with this device a single operator can control an entire battery of machine guns or automatic rifles.

SHOE HEEL FASTENER.—H. VARWIG and F. CALDWELL, 7510 Cornelia Ave., Cincinnati, Ohio. The invention has for its object to provide a device especially adapted for connecting wooden heels of ladies' shoes, wherein means is provided adapted to be arranged between the heel and the sole to connect the heel to the sole without the use of nails in connection with the sole.

COOKING UTENSIL.—C. V. TIERS, 338 Fourth Ave., Oakmont, Pa. The invention relates to cooking utensils adapted to be used as a double boiler; a steam cooker; a canner or preserver; a pudding cooker; or as a cooker of vege-

VERTICAL SECTION OF A COOKING UTENSIL EMBODYING THE INVENTION

tables, cereals or the like. An object is to provide a utensil the economical use of water in which makes it practical to leave the utensil on the fire a long period without danger of the food being dried out, the utensil is readily convertible, the outer and inner vessel being used separately when desired.

BABY COMFORTER.—MARY WILSON, Princess St., Northcote, Auckland, New Zealand. The invention relates to a comforter and teething device, and particulary to a device made of suitable shape and of a size to be inserted in a child's mouth. Object is to provide a comforter formed of two main separable members adapted to be readily cleaned and maintained in a sanitary condition.

SAFETY RAZOR.—W. F. CARY, 208 East 44th St., Chicago, Ill. The invention relates more particularly to that type of razor in which the blade and guard are separate from each other, and separate from the resilient handled clip in which they are held for shaving. An object is to provide means whereby the blade may be grasped between the thumb and finger for stropping so that the stropping may be done after the ordinary manner.

FLAG CONTROLLING APPARATUS.—A. MILLER, 70 Greenwood Ave., East Orange, N. J. Among the principal objects which the invention has in view are to maintain the service relation of flags, to avoid injuring the flag while limiting its movements, to provide for storage of the device within limited compass, and to provide means for readily installing the device upon a flagstaff.

AUTOMATIC SPRAYING BOTTLE.—L. K. MOBLEY, 471 Park Ave., New York, N. Y. The invention relates to devices for spraying the throat, for example, with an antiseptic solution and more particularly has in view a compression

(*Continued on page 556*)

FULTON

One Fulton—Then Three More

Four Fulton Trucks are handling transportation for Wm. G. Dann, Ice and Hauling Contractor of East Orange, N. J.

Every one of these sturdy Fultons is averaging under all road and load conditions 12 to 14 miles to the gallon of gasoline.

It was their speedy, economical delivery of dependable power, whether in gruelling hill-work or along level roads, that was responsible for this contractor's first Fulton Truck being joined by three more Fultons within a year—again proving Fulton to be "the repeat order truck."

And it is this dependable low-cost delivery, likewise, that has placed Fultons in the fleets of such great national concerns as Standard Oil Co., Pittsburgh Plate Glass Co., Borden Farm Products Co., Inc., Texas Oil Co., John Wanamaker, Walvoline Oil Co., etc.

Do you know the Triple-Heated-Gas motor? It is an exclusive Fulton feature—an important factor in the recognized economy and power of Fulton trucks.

Fulton efficiency is convincingly shown in reports of Fulton Users. Ask to see them.

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Fulton distribution may allow for further extension in your territory. Write for details.

THE FULTON MOTOR TRUCK COMPANY

At-The-Port-of-New-York **FARMINGDALE, LONG ISLAND**

"The Repeat Order TRUCK"

RECENTLY PATENTED INVENTIONS

(Continued from page 554)

Of General Interest

spring and lever sprayer for home use and employing a solution charged with carbonic acid gas, thereby promoting facility in the use of the sprayer over sprayers of the type employing a bulb or the like.

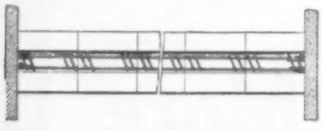
VULCANIZING FUEL.—W. E. Mouck, Santa Barbara, Cal. The invention relates particularly to a fuel composition adapted for use in vulcanizing in which an important desideratum is the assurance that the composition will promptly ignite and develop the required degree of heat as well as possess the property of sustaining the heat over the required period. The composition is made up of sawdust, 10 to 20 parts; ground walnut shells, 10 to 20 parts; saltpeter two to four parts; and celluloid one to two parts.

DELAY ACTION DETONATOR.—P. L. E. del Fungogiera, 144 Harmon Ave., Pelham Woods, N. Y. The invention relates to high explosive devices with respect to either military or commercial uses. Among the objects is to provide a detonator, equipped with a slow or time controlled fuse, and associated with means to transmit the effect of the fuse to the main charge of the high explosive.

CHEMICAL BASE-DETONATOR.—P. L. E. Del Fungo-Giera, 144 Harmon Ave., Pelham Woods, N. Y. The invention has particular reference to ordnance shells charged with T. N. T. or the like requiring unusual means or facilitie for detonation. An object is to provide a high explosive shell adapted to be fired chemically, the same being provided with means to safeguard the handling of the shell and preventing premature explosion even after it is fired.

BOILER SAFETY TUBE.—V. Hansen, 212 Cypress Ave., Wallace, Idaho. This invention is more particularly intended for use in steam boilers of the fire-box type, and has for its general object to provide means to prevent collapsing of the crown sheet with the resulting explosion of the boiler, in case of low water in the boiler. The object is attained by means of a safety tube with thin walls, which will quickly become overheated and collapse, permitting the water and steam to escape and extinguish the fire.

CULVERT.—M. R. Deyo, Box 102, Bradford, Ill. The invention has for its object to provide a culvert formed from hollow tiles formed from plastic material capable of hardening, the tiles



A SIDE VIEW OF SECTION SHOWING CULVERT AND HEAD WALLS

being placed end to end and having means in connection therewith for permanently locking them together and to the head walls, and wherein a continuous compound reinforcement is provided for the construction.

BOOKBINDER.—J. J. Ralek, address H. R. Huntting, 368 Main St., Springfield, Mass. This invention has particular reference to temporary binders for newspapers, magazines or the like. Among the objects is to provide facilities for binding or holding periodicals, the several units being adapted to be attached or filed in an easy manner; the assemblage may be removed and replaced, but whether complete or not may always be handled as a single complete volume when detached from the binder.

SHIP'S PATCH.—P. C. Warner and R. W. Blodget, 101 Park Ave., New York, N. Y. Among the principal objects which the invention has in view are, to provide means for closing a gap in the hull of a ship, to provide means for readily disposing the filling member in active service, to accommodate leaks or apertures of unascertained size and shape, to provide patches of the character mentioned which are conveniently transported and adapted for augmenting the flotation of a ship.

SHIPS' LOG.—C. P. Maxson, care of S. S. Monus, Pier 49, New York, N. Y. Among the principal objects of the invention are to provide means for repeating at the navigating officers' station, the indication of the taffrail instrument of a ship's log, to provide means for continuously showing to the navigating officer of a ship the trailing log indications, and to simplify the construction of the mechanism necessary to accomplish the object.

FASTENER ATTACHMENT FOR RUBBERS.—F. J. Nelson, Hallock, Minn. The invention is more particularly intended for application to a pair of rubbers. The prime object is to provide a fastening means for rubbers or other articles of footwear whereby to fasten the pair together when they are not in use, thereby preventing the loss of time and confusion, as well as inconvenience in locating the rubbers of a pair, and preventing the loss or accidental exchanging of rubbers.

NON-REFILLABLE CONTAINER.—P. Bergen, care Monticello Public Schools, Monticello, Wis. The invention particularly relates to a glass container, a portion of the neck of which is adapted to be broken off for gaining access to the contents. The fracture of the bottle neck will be required to follow predetermined lines, whereby the permanent neck portion will not present a jagged form, the base portion or permanent part having the strength to withstand the forcing of a cork therein after the upper portion has been broken off.

ATTACHMENT FOR RIBBON ROLLS.—W. A. Johannsen, Paullina, Iowa. The invention relates to a means adapted to be attached to a ribbon roll to hold the ribbon and the usual paper strip from accidental unwinding. The general object is to provide a member having means to detachably secure it to a face of the usual paper or pasteboard drum of a roll and whereby the attachment may be used on successive rolls.

DOLL'S DRESS.—J. Baum, 1996 Bedford Ave., Brooklyn, N. Y. The object of the invention is to provide a doll's dress which forms a permanent part of the doll. The dress comprises a body having sleeves and legs formed of braid of a textile material, the braid being arranged in layers around the body, arms and legs of the doll, and stitches fastening the edges together.

Hardware and Tools

WRENCH.—T. E. Miller, 2401½ Pacific Ave., Tacoma, Wash. The invention relates generally to wrenches, but more particularly to a quick adjustable wrench, which will fit various types and sizes of nuts, and which may be readily adjusted from the handle in order to bring about proper engagement of such nuts.

VALVE GRINDER.—C. D. Rosecrans, 856 Mililani St., Honolulu, Territory of Hawaii. This invention relates more particularly to a valve grinder for use with the valves of internal combustion engines, insuring the gripping of the valve and facilitating its removal and manipulation for grinding. The grinding includes a vacuum cup adapted to be applied to a valve, a stem on said cup at the back, a tubular holder having threaded engagement with the stem, a handle shank, and means loosely securing said holder at its rear end to the front end of the shank.

ROCK DRILL.—T. Gordon and H. W. Simpson, Box 21, Union Bay P. O., Vancouver Island, B. C., Canada. The general object of the invention is to provide a drill, the bits of which are detachably secured to the drill socket in such a manner that short bits can be employed involving the minimum amount of steel to keep a given number of machines going by providing two, four or other practical number of sets of bits for each drill. As no welding is involved in the cutting bits a much higher grade of tool steel can be used.

COMBINATION LATHE TOOL.—J. Waczula, 433 E. 72d St., New York, N. Y. A specific object of the invention is the provision of a tool holder having a form of head whereby a cutter-holding gooseneck, a boring tool or cutters may be mounted therein in various positions, the clamping means in the head being such that the adjustments can be easily and quickly effected. A plurality of cutters can be clamped in the gooseneck, one at a time, by a single clmaping bolt.

SUPPORT FOR PRESSER IRONS.—M. Epstein, 317 E. 6th St., New York, N. Y. Among the objects of this invention is to provide a support for a presser iron of such a character that there is provided in connection therewith automatically operating power means sufficient to hoist the iron far enough to clear the work so that the iron may be transported laterally or out of the way for change or readjustment of the work or garment to be operated upon.

HORSESHOE.—C. C. Ferguson, 305 So. Randolph St., Champaign, Ill. The invention relates more particularly to that form of horseshoe known as an "ice shoe," and has for its object to produce an effective, and lasting shoe and one that can be set without the employment of a blacksmith or other skilled laborer. Another object is to produce a shoe that can be attached to any size of hoof, from a mule to the largest horse.

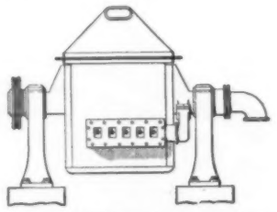
Heating and Lighting

WATER HEATING SYSTEM.—V. E. David, 1954 Jones St., Apt. 5, Omaha, Neb. The invention relates to water heating systems of the instantaneous type, and has for its object to provide electrically controlled heating means for heating the water, interposed in the length of the water pipe, and wherein other means is provided for controlling the supply of current to the heater operated by the flow of the water to be heated.

Machines and Mechanical Devices

DITCHER AND GRADER.—F. O. Schlueter, address H. M. Kidder, 5th and Main Sts., Fremont, Neb. This invention relates to a tractor-driven machine adapted for ditching, road grading and like work. An important object is to produce a rotary cutting shovel wheel operating in a manner to effectively cut the ground and pitch the cut material onto a conveying or elevating means, whereby to carry the material to a side of the ditch or road.

BESSEMER CONVERTER.—A. Rommelaere, 80 Fifty-second Ave., East, South Vancouver, B. C., Canada. The invention relates more especially to Bessemer converters of the side blown type, in which one or more twyers are used.



A SIDE ELEVATION OF THE DEVICE

An object is to provide a converter of this type with a wind box having a knock-out back. This is accomplished by cutting away the shell of the converter the full length of the wind box, thus providing a space whereby the refractory lining may be easily removed or replaced.

COFFEE ROASTER.—E. T. Shortt, address Miss Holley, 4528 Ross Ave., Dallas, Texas. This invention relates more particularly to roasters of the form described in Patent No. 1,122,651 granted to the same inventor, which among other things is characterized by a roasting drum with electric heating means, and by a suction means thus doing away with noxious fumes. The general objects of the present invention are to provide a roaster which is sanitary, and with which an increased conservation of the strength of the coffee, as well as an effective agitation of the coffee while roasting.

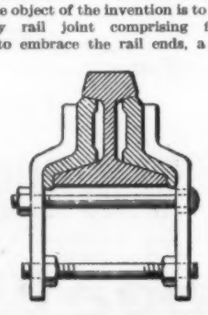
EMBOSSING AND PRINTING MACHINE.—B. R. Corley and R. Turner, 409 Pearl St., New York, N. Y. The invention relates to machines for embossing and printing letterheads, business and visiting cards and other stationery by means of a die or engraved steel plate. The object is to provide a machine with inking and wiping devices arranged to insure proper inking and wiping of the face of the die without requiring any attention on the part of the operator and without waste of the wiping material.

CENTRIFUGAL CASTING BOX.—G. C. Clark, care Luzerne Hotel, 79th St. and Amsterdam Ave., New York, N. Y. The invention relates to a centrifugal casting machine. The object is to provide a casting box arranged to insure the formation of cast rings or bands of high tensile strength and without danger of cracking the cast rings especially along the peripheral faces thereof. Another object is to prevent undue adhesion of the molten metal to the inner surface of the casting box thus allowing ready removal from the box.

SUPPORT FOR EXPANDING METAL ARTICLES.—E. Abarca, Succors de Abarca, San Juan, Porto Rico. Among the principal objects which the invention has in view are, to avoid unequal expansion of metal articles when reheating the same, to avoid unequal stresses in articles of the character mentioned during the reheating, and to equalize the internal stresses of expansion set up in articles while reheating the same.

Railways and Their Accessories

RAIL CLAMP.—O. O. Bordson, Cross Plains, Wis. The object of the invention is to provide an emergency rail joint comprising fish plates adapted to embrace the rail ends, a clamp for



A SECTION SHOWING THE CLAMP IN USE

clamping the plates on the rails at each end of the joint, each clamp comprising a pair of bars shaped at their upper ends to fit the outer faces of the fish plates, a bolt connecting the bars, and means at the lower ends of the bars for forcing said ends outwardly and the upper ends inwardly.

TRAIN STOP.—W. H. Lowell and M. T. Wintsch, 18 E. Orange Ave., Lancaster, Pa. The invention relates particularly to electro-magnetic controlling devices comprising a gravitationally-operable shoe adapted to be disposed alongside a railway track, electro-magnetic means for raising the shoe against gravity, second electro-magnetic means for engaging the shoe in the raised position, a normally closed circuit for the second electro-magnetic means, a switch in the circuit, and a movable railway signal for operating said switch.

Pertaining to Recreation

TOY BOAT.—J. Kohn, 11 E. 17th St., New York, N. Y. An object of the invention is to provide a toy in the shape of a ship or other article with movable parts, and a releasable catch for holding the parts together whereby when an object is thrown or shot against the catch the parts will be released for giving the effect of a boat being blown up by an explosive shell.

Pertaining to Vehicles

WHEEL.—W. S. Watson, 610 Hippodrome Bldg., Cleveland, Ohio. The invention relates more particularly to the hub construction of a wheel. An object is to provide a wheel which is of all steel construction, and whose parts are made by stamping or punching from steel plates, and to provide in a hub, means for placing uniform tension in spokes, thereby equalizing vibration, shock and recoil by elongation and construction of curved spokes arranged in pairs.

TABLE TRUCK.—S. C. Dodson, 2304 E. Fayette St., Baltimore, Md. The invention relates generally to trucks for transporting articles, and particularly to a partially collapsible truck for merchandise of every description by manufacturers capable of use as a checking table, so as to avoid the necessity of transfering the goods, an object is to provide improvements in table trucks as claimed in Patent 1,149,995 granted to the same inventor.

WALKING ATTACHMENT FOR MOTOR VEHICLE.—O. E. Jenson, Roseberg, Alberta, Canada. The invention has for its object to provide a device for attachment to motor vehicles such as are used to carry heavy loads or to draw trailers over rough roads or excessive grades, in order to obtain sufficient tractive force to propel the vehicle and its load without great loss of power. The attachment consists of two similar sections, one of which is adapted for attachment to each end of the rear axle of a vehicle.

COMBINED BLOW-OFF AND HOSE CONNECTION FOR TIRES.—S. Kahn, 83 Court St., Newark, N. J. This invention relates to pneumatic tire apparatus and has special reference to automatic blow-offs as adapted particularly for permanent connection with tubes leading from compressed air tanks or pumps for application to tires in garages or analogous places; the device is of such a nature as to be automatically disconnected from the container when the desired degree of pressure is attained in the tire.

AUXILIARY HOOD FOR AUTOMOBILE ENGINES.—S. T. East, Norwood, La. Among the principal objects which the invention has in view are to provide means for protecting the engine of an automobile and parts connected therewith from rain and snow: to provide means for retarding the radiation of heat from an automobile engine, and to construct and arrange the hood so that the same may be acquired and applied as an accessory.

MAGNETO-COUPLING.—R. H. Pierce, Eugene, Ore. The invention relates to an impulse coupling adapted for use in connection with a magneto to produce a hot spark at slow engine speed, as when the engine is being cranked, thereby enabling the largest engines to be started on the magneto without the use of batteries. The device is comparatively simple, and so designed as to be automatic in operation.

Designs

DESIGN FOR A CARRIAGE RATTLE.—L. Morse, 35 W. 36th St., New York, N. Y.

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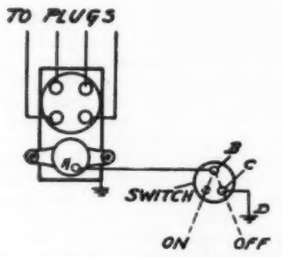
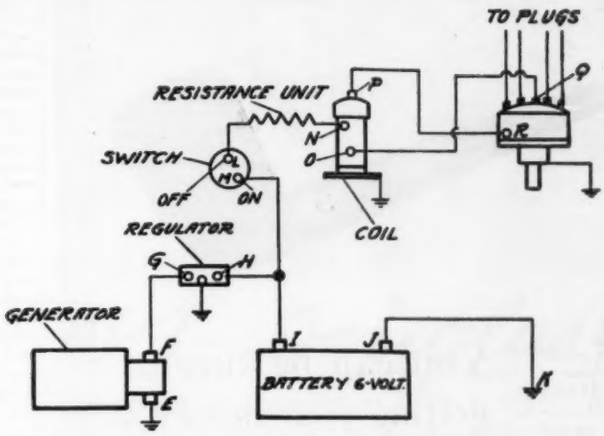


The simple and dependable Magneto System



The complicated Battery System

Dependability Always the gauge of the Automobile

Collierville, Tenn.,
February 19, 1919.

Splitdorf Electrical Co.,
Newark, N. J.

Gentlemen:

I am writing to you with reference to the Dixie Magneto, an advertisement of which I saw in the Country Gentleman.

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Please give me information about your magneto as to cost, guarantee, just what service it will perform, etc.

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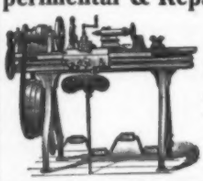
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Reconstruction in the United States

(*Continued from page 540*)

information of the government's labor program or suggestions, the financier who wants the latest information available as to what the treasury is going to do about any vexed question, the business man who wants the latest pronouncement from all the government bureaus which will affect the tile industry, the making of pins or pianos or planting peanuts, can get it here and get it quickly.

The fourth file is a State Activities file, which keeps available and fluid the work of the individual states.

In addition to all this, the Research Division has made some surveys of the work of the government which have been a revelation to almost everyone who has seen them. The government machinery at Washington is a mighty engine, indeed. It is so vast that many a man who has lived a cog in it all his life has no idea of its magnitude. Here, probably for the first time, have a series of investigations been made which have resulted in charts, which spread a working plan of the government before the eyes of him who reads.

The first of these charts shows in graphic form the reconstruction activities of every government department which has such, every war created organization in the government, such as fuel, food and railroad administrations, the Council of National Defense itself, War Trade Board, War Industries Board, etc., and all the related organizations which are extra-governmental, such as Red Cross, Y. M. C. A., U. S. Chamber of Commerce, labor organizations, etc., etc. In other words, it is a birds-eye view of all forces working on any phase of reconstruction.

The second chart is of the reconstruction agencies of the Federal government arranged by agencies. Here the larger governmental divisions are subdivided, so that, for instance, under Agriculture, one finds not only the department and its activities but those of all its bureaus engaged in reconstruction work, such as the Office of Farm Management, the Forest Service, the Bureau of Highways, and the Bureau of Markets. Under Department of Labor is found citations of the work of the Special Committee on Reorganization, the U. S. Employment Service, the Bureau of Immigration and the Children's Bureau.

The third chart is concerned with a survey of all the official agencies created for war purposes, exclusive of the War and Navy Departments. This chart gives the agency, the authority for its creation, its functions and whether permanent or terminable and, if the latter, the date.

Chart four lists the readjustment activities of Federal Agencies arranged by topics so that one can find just what and who is working on demobilization and placement, what government bureaus are concerned in social and political welfare work, where to go to get all information relating to foreign and domestic trade, etc.

Nothing like this has ever before been done for the government of those who use the governmental machinery. There has never been, strange as it may seem, any one central source of information as to just what the Federal agencies were at work upon. This, coupled with the daily digest of reconstruction news, by which each department and each bureau in each department is kept advised as to what every other department is doing, which in any way affects any reconstruction program or policy, must be looked upon as a work the value of which cannot be measured in either time or money, but without which we could, individually or officially, proceed at best but slowly and in the dark.

Created for and functioning expressly to aid the government all this reconstruction information is very much at the service of those individuals, corporations or other interests which need it, either by letter, telephone, wire or personal interview. The Research Division is the point of contact between both government as a whole and the functioning of parts of the government, between part and part, and between the public or any member of it and any part of the government machinery, so far as reconstruction is concerned; when it is better known to the people it can serve, its power for constructive effort in reconstruction will very evidently become immeasurable.

The Case for Water Power

(*Continued from page 541*)

water power amounts to nothing at all; and here the topography is solely responsible, the entire settled portion being located in prairie country which possesses no natural water-power sites.

Nor is our northern neighbor the only one of our contemporaries that has begun to tap the great supply of stored sun-power represented by the water that runs down hill all over the surface of the earth. In Great Britain, traditional coal-burner, proposals have been put forward for vast central station plants, and careful stock is being taken of all the water powers of the United Kingdom. Since the outbreak of the war and the divorce of Italy from her previous sources of coal supply, the Italian Government has proceeded with an active water-power policy; in 1917 and 1918 concessions were granted for 1,024,000 horse power. Norway has developed 1,120,000 horse-power, and plans to export current to Denmark. Barcelona, in Spain, is replacing steam power by hydroelectricity. In Switzerland fully a quarter of the two millions of hydro-horse-power available have been developed. All these items are straws showing where the wind blows. They indicate that other people are laying a better foundation for power for the years to come. It is with these peoples that we must compete for the world's trade.

Connecting Staten Island with Manhattan

(*Continued from page 545*)

York City. An alternative route is shown at B. This calls for a tunnel to Ellis Island and thence to the Jersey shore, where the tube would rise out of the Bay and the line would be continued by a bridge within the bulkhead line of the Jersey shore to Constable Hook. Here a tunnel would dip under the Kill van Kull and run into Staten Island. This plan would possess all the advantages of Route A with the additional advantage of providing for travel out in the open through most of the course. Both of these plans are proposed by the Staten Island Chamber of Commerce.

Route C is a direct tunnel running all the way from Staten Island to New York which has been suggested by John F. O'Rourke.

Of course all tunnel schemes are expensive, particularly when they depend merely upon the traffic provided by Staten Island. For this reason, Route D has been proposed by Gustave Lindenthal, which consists of a tube under the Hudson River to Jersey City and thence a railroad to Bayonne, with a tube under the Kill van Kull at Constable Hook. Such a route would provide for taking on passengers at Bayonne, and, other points and would probably carry more traffic than would the direct tunnel route.

Route F proposed by S. Johannesson, is similar to Route B, in that it provides for tunnel connection with Ellis Island and Communipaw, but advantage is taken of Ellis Island to bring the tube out of water and extend it as a bridge direct to Staten Island without a dip under the Kill van Kull. A drawbridge would be necessary to accommodate shipping coming from Newark Bay through Kill van Kull. Our frontispiece gives an illustration of the proposed bridge, showing how it rises out of the ground at Ellis Island. The bridge is high enough to permit tugs and lighters to pass under at any point, but, of course, a drawbridge would be required for larger vessels. The bay along the Jersey shore is shallow, with bed rock near the surface, so that no difficulty would be involved in building bridge piers.

LEGAL NOTICES

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contains Patent Office Notes. Decisions of interest to inventors—and particulars of recently patented inventions.

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PATENT 1,296,372 on entirely new stump puller. Pulls stumps straight up and pulls with tractor. T. H. Monk, Thomasville, Georgia.

In addition to a direct connection with Manhattan, it is proposed by John F. O'Rourke that a vehicle tunnel be run to Bay Ridge, as indicated at E. This tunnel, being practically two miles in length, would meet with the same objection that was brought forth against the Hudson vehicle tunnel, namely, the difficulty of ventilation. A novel suggestion has been proposed to overcome the ventilating problem. Vehicles would not pass through the tube under their own power. Instead there would be direct lines of railroad through the tube on which trains of flat cars would be run. These trains would be electrically propelled, and on the flat cars the vehicles would be carried. This would provide uniform rapid transit for all classes of vehicles, and there would be no poisonous fumes liberated in the tunnel.

We shall not attempt to pass upon the relative merits of these various plans, but it is clearly evident that something must be done, and done soon, to connect Staten Island more closely with the city.

Better Packages and How to Know Them

(*Continued from page 546*)

the nails. The wood may split or break across the grain.

Any one of the numerous weaknesses of packing box construction may be developed in this test until finally the observer is able to build up a box that is practically equally strong in every feature. Boxes are then built, packed, and tested until the presence of this balance in design is clearly demonstrated. Such a demonstration will show failures ultimately occurring in average proportion in nails pulling from the wood, wood pulling from the nails, splitting or breaking of ends, sides, tops or bottoms, and through the weaknesses of the species themselves.

Accelerated Tests for Overseas Shipping Containers

The special box testing machines at the Forest Products Laboratory at Madison, Wis., have been of considerable service during the war. Specifications prepared largely in the U. S. Forest Service were adopted by the General Staff for the entire War Department. These specifications allow the use of all species of wood suitable for boxes and crates, and require different thicknesses of material, spacing and size of nails, etc., depending on the requirements of use. These general specifications have reduced costs very materially, increased the sources of supply, and opened the field to package manufacturers generally.

About 20 types of boxes have been redesigned for the Ordnance Department of the Army and other bureaus and services. The Ordnance Department reports that the Service recommendations have proven of immense value; the boxes recommended have generally proven cheaper than the original designs owing to the use of a large number of species rather than white pine alone, and the use of standard types of construction and standard thicknesses of material.

Saving in Space in Overseas Shipments

The boxes recommended have generally been of considerably less displacement than original designs, and the money value of the shipping space saved has been a very large item. As specific examples, new specifications for ordnance equipment boxes made possible the use of about 30 species rather than high-grade white pine alone, admitted thinner material, and saved cargo space. These boxes were shipped by the million. There was a distinct space saving in grenade boxes through redesign and shipments were made by thousands. A redesign of a box to carry 30 one-pound cans of saddle soap saved 43 per cent in cargo space. A box designed to carry 140 pounds of cannon powder was redesigned and effected a saving of 14 per cent in cargo space. A box designed to carry two Browning automatic machine rifles with equipment

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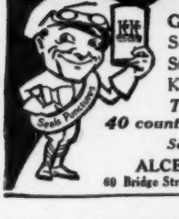

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The SCIENTIFIC AMERICAN has for many years had an office in the Peoples Gas Building. This office has been transferred to the Tower Building and is consolidated with the new office of Munn & Co.

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was redesigned with a saving of 28 per cent, both in cargo space and material. A box designed to hold 10 U. S. 1917 model rifles was redesigned and 33 per cent of cargo space saved. A redesign of a harness box saved more than two cu. ft. per box.

Official reports from France say that since the first of July broken packages received are only 15 per cent of prior losses and now compare favorably with domestic shipments. This is in part due to the application of the results furnished by the Forest Service.

Recommendations by Service experts on waterproof case lining paper were adopted by the Ordnance Department of the Army for all packing boxes containing personal and horse equipment and tools, and are reported to have proven very satisfactory.

Forest Service recommendations concerning the water-proofing of labels were adopted by the Ordnance Department of the Army with satisfactory results, and later were approved by the General Staff for the War Department.

Various miscellaneous investigations made on strapping, seals, patent boxes, etc., are reported by the Ordnance Department to have been of great value in that they have permitted the adoption of standard specifications, insuring material of safe and standard quality.

The Cockpit of the Transatlantic Seaplanes

(*Continued from page 547*)

as the compass was an indication, might actually be moving on a course diverging considerably from the true course. The drift indicator works in coöperation with some fixed mark upon the surface of the water, and to provide such a mark the navigator carries bombs which are dropped and ignite upon striking the water giving forth for several minutes a dense smoke and a bright light. If the ship is being driven by the wind, say, to the south of her course, the object on the water will appear to move north across the vessel's course, and vice versa. By means of the drift indicator, the amount of this movement in a given time is recorded. Since the navigator knows his own elevation above the water and his own speed, he is able to calculate the speed and course of the wind. A simple calculation will now tell him how much he must head up into the wind to maintain his vessel upon its true course.

In the event of dense fog interfering with the use of the drift indicator, the navigator will be assisted by his radio compass which, if all goes well, will give him warning, if he begins to diverge from his course.

The two little cylinders which will be noticed in our photograph attached to the bow of the boat are two very powerful flares for use in night landing. When in use, they are drawn down by elastic cords so as to project diagonally towards the point of landing. They are ignited electrically, and throw a strong illumination upon a considerable area of the water below and in front of the airplane.

A Megaphone of Novel Design

(*Continued from page 548*)

placed at the small end of the megaphone. Sounds in the air, such as that of an airplane, may be located by this method. The megaphone is held with the major axis of the aperture horizontal and then moved around in a horizontal circle until the airplane sound is heard. This locates it in a vertical meridian. The megaphone is then turned with major axis vertical and moved on the vertical meridian until the sound is again a maximum when it will be found to point directly at the airplane. This may be done with the eyes shut and more quickly than it takes to tell it.

The form of aperture need not be rectangular. An elliptical aperture will bring the same result; the essential condition being that one axis is greater than the other and both proportioned for maximum effect to the average wave length of sound. It is applicable for music as well as speaking.

Heating Water by Means of Electrolysis

(*Continued from page 552*)

Cylinders, fitted inside one another, are here used instead of plates. In order to make it as compact as possible the cylinders are placed very close together, being separated by ¼ inch. The can is something like a coffee pot, being 10 inches high and six inches diam. The three plug connections, *D E F*, are for the three phases. The cold water passes first into the inner portion of the can and then flows into the spaces between the cylinders, and so reaches the mouth *G*. It can be hung on any water tap. The temperature can be regulated by cutting out one of the phases, exactly as in the other type. Tests have shown that 25 amperes at 220 volts will boil one gallon of water. According to the speed at which the water passes through the can, its temperature will be warm or hot.

Recent Patent Decisions

WHERE a defendant sold an infringing washing motor, and the ordinary sales unit consisted of the tub, fixtures, and infringing motor, held, that the profits from the sale of fixtures could be recovered only insofar as the fixtures were useful solely in connection with the style of motor infringed, and complainant could not recover profits on that part of the fixtures which could be used in connection with other styles of motors. An infringer, accounting for profits, is entitled to credit for the expense of advertising the infringing article. Where the infringement was deliberate, all doubts as to profits should be resolved against the infringer.—*Coffield Motor Washer Co. v. Wayne Mfg. Co., U. S. C. C. A. of Mo.*

In the patent for an invention to treat the human body by confining and applying electric light and electric heat by means of an enveloping chamber, the record discloses a former patent issued to one Gohlin in 1900. It shows that Gohlin conceived the idea of applying heat and light generated by electricity to the body below the shoulders. He used two structures, each mounted on a standard and wheeled up on either side of the bed or table on which the patient rested. From these supporting standards curved parts projected inwardly and formed a top, and the two met and made a chamber substantially the length of the human body. Curtains were then drawn at the end of each chamber and the electricity turned on. Two and a half years after the issuance of this patent, the patent in suit was applied for. It is quite manifest that when the patent in suit was applied for the applicant was unaware of what Gohlin had done or of his patent, and realized his own improvement. Then he filed a new application properly describing what he brought into the art. This was a simple, easily movable, readily adjustable apparatus without standards or support. It was adapted to take such different forms that it could be used on any limb or part of the body, and thus create a chamber which could in size and shape bring its walls into closer relation to the member to be affected by its radiated heat and light. He dispensed with standards by suspending his simple apparatus by ceiling cords. This allowed it to be swung about and to be placed in any position desired. It could be picked up by a handle. He used a hinge which allowed the sides to be adjusted and wrapped about the heated part. Held, that the patent is entitled to a construction broad enough to protect the valuable contribution of the patentees to the art.—*Edmands v. Perlman, U. S. C. C. A. of Pa.*

The wardrobe trunk was produced by Seward at first, and had in combination a gate hanger pivotally mounted within the cover portion, brackets extending laterally from said gate hanger, and garment hangers having a two-pointed suspension mounted upon said bracket. As soon as

(*Continued on page 563*)

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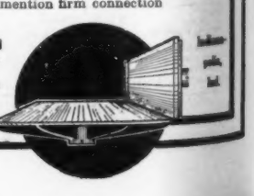

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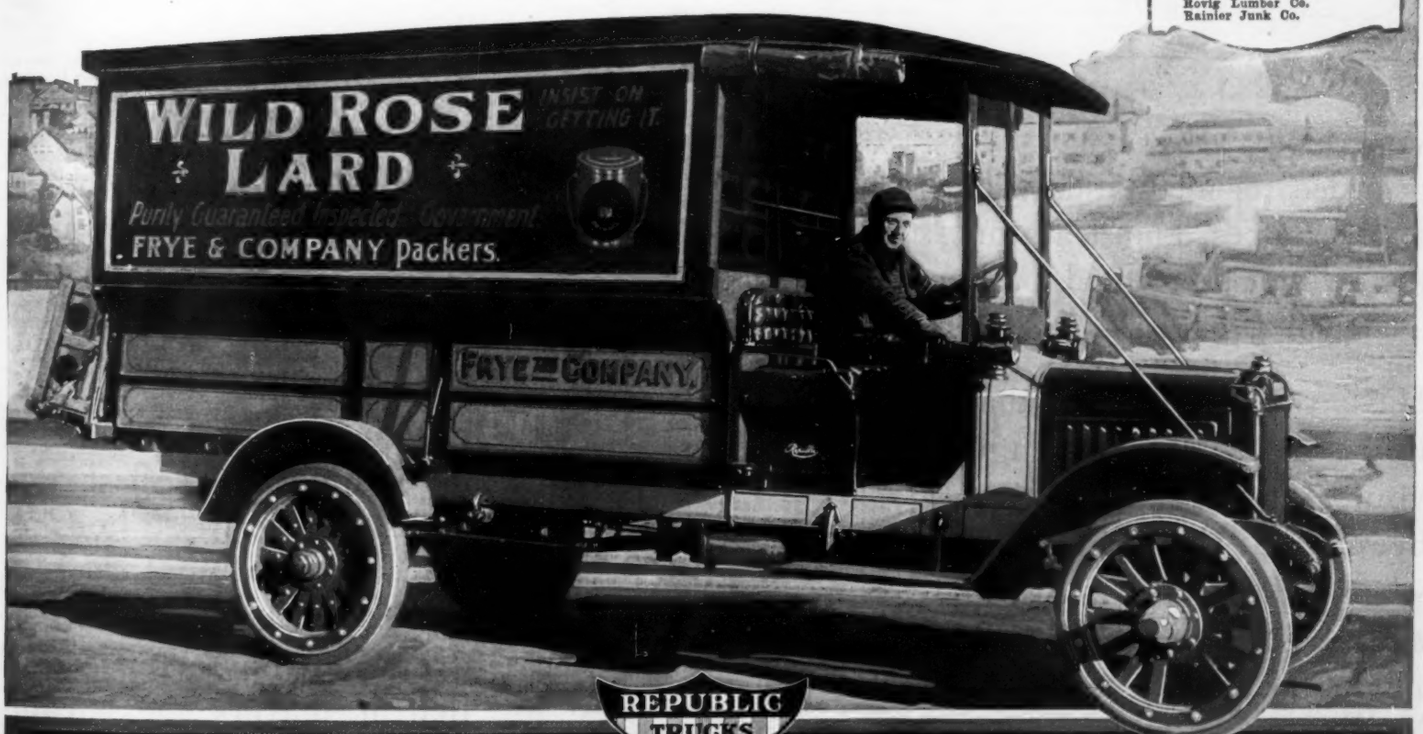

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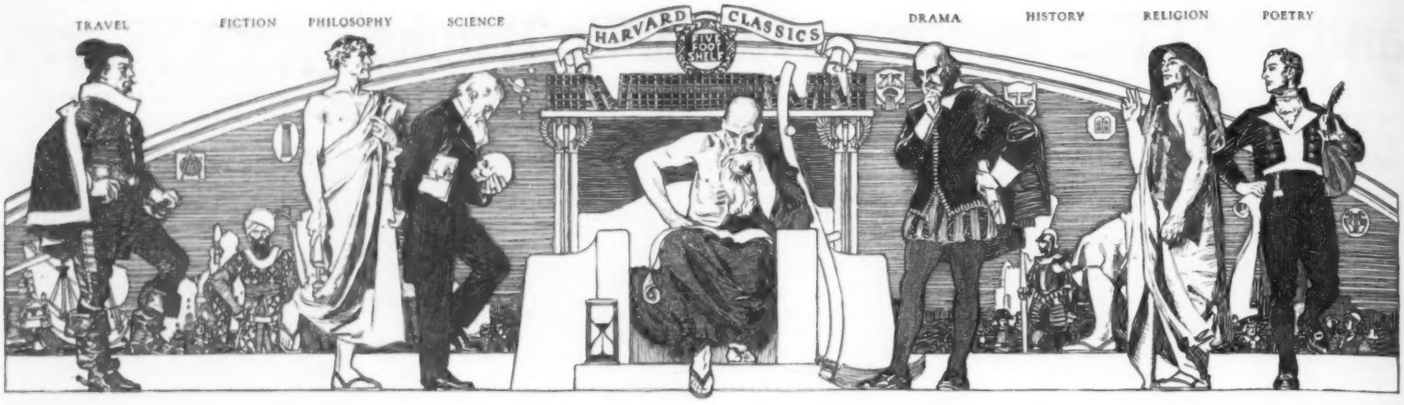

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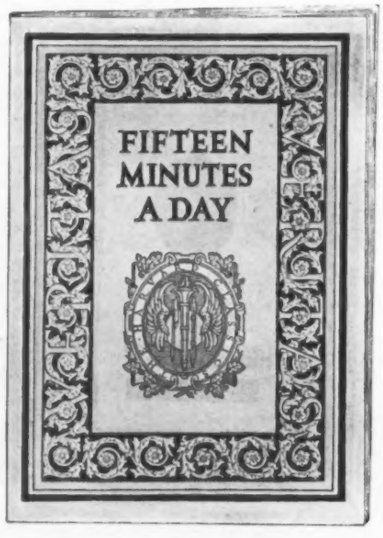

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Recent Patent Decisions

(Continued from page 560)

Seward disclosed it, his trunk went into such wide use that his combination attracted the eyes of infringers. In the disclosures of the Patent Office, these infringers found nothing but Seward's combination, and they now urge that in the archives of the patent office there exist, not Seward's workable combination, but isolated elements of that combination, which should have suggested to him his successful combination. Held, that Seward's was an original conception, every element of which, coöperating in a new working way, made Seward's trunk a success. Earlier trunks were failures. Seward gave the public something workable and novel and the public put its seal of approval on his work, and the court sustains the validity of the patent.—*Rauchbach-Goldsmith Co. v. Seward Trunk & Bag Co., U. S. C. C. A. of N. J.*

The invention relating to the commercial construction of sound records in having for its object the production of a number of copies of an original record of a graphaphone, consists in cutting or engraving upon a tablet of suitable material, by means of the lateral vibrations of a stylus, a record groove of uniform depth and having lateral undulations corresponding to the sound wave, next coating the same with a coating material, then forming a matrix thereon by electrolosis, and finally separating this matrix and pressing the same into a tablet of suitable material. Suit for infringement. The claims of the patentees are for a combination and it is contended on behalf of the invention above described, called the Jones Process that the great value of it lays in the matrix, although in prior trials, the courts held differently. The Jones patent held not infringed. A patent issued pending application for the one in suit, although on a prior application is not in a prior art. This patent has been the subject matter of considerable litigation and was adjudged valid in American Graphaphone Co. v. Universal Talking Machine Mfg. Co. and same v. American Record Co. and American Graphaphone Co. v. Leeds & Catlin Co. —*American Graphaphone Co. v. Emerson Phonograph Co., U. S. D. C. of N. Y.*

The patent herein is an invention for improvements in electro-mechanical water wheel governors. In his specifications the inventor sets forth that governors used to regulate the water supply to the water wheel in general operate only to open or close the water wheel gate, thereby allowing the admission of a greater or less supply of water. The first effect of such opening or closing of the gate, owing to the inertia of the water, is always the opposite to that which it is desired to bring about, *i. e.*, the opening of the gate operating to momentarily cause less velocity of water at the wheel, owing to the great orifice the water has to flow through, and, vice versa, the closing of the gate operating to momentarily cause an increase of velocity, owing to the contraction of the orifice. To overcome these opposite effects, the patentee provides a by-pass inserted into the flume at a point near the water gate and a gate in the by-pass controlled by the same governing mechanism that controls the water gate and operating to allow a greater or less flow through the by-pass, according as the water gate is being closed or opened. Other principal features relate to means for preventing excessive action of the governor and to control of the governor by a dynamo driven by the water wheel. Appellant contends that prior to this patent there prevailed in the art an absolute want of sensitive speed governing and that there were fluctuations occurring in the supply of electrical energy produced by any generating unit. Obviously constant speed in the use of power from a water wheel is desirable, and inventors have sought to maintain an equilibrium between the power of the water projected upon the buckets or blades of the water wheel and mechanical power being taken from the water wheel. There never before has been a water wheel governor constructed in accord with the drawings and specifications of the patent in suit. The scope of every patent is limited to the invention described in the claims, read in the light of the specification. A patent for a device which has never gone into actual use may properly be limited to what is plainly shown and distinctly claimed. Appeal from a decree dismissing the complaint of appellant, Henry, upon the ground that the Lyndon patent here involved was not infringed. Held, not infringed.—*Henry v. City of Los Angeles, U. S. C. C. A. of Cal.*

Our Trans-Atlantic Dirigible Entry

(Continued from page 549)

favorable winds. Under the most favorable conditions the dirigible can remain aloft some 70 hours, at a speed of some 30 miles an hour, the engines, in this case, being run singly and alternately so as to economize fuel.

As likely as not the C-5 has been provided with extra fuel tanks for the great flight, but nothing official has been given out about the matter. It would seem that the average speed maintained on the first leg of the flight, taking into consideration the favorable winds, was not as great as it might be. Hence the inference follows that the gasoline capacity has been materially increased so as to permit of a non-stop flight between Newfoundland and the British Isles, instead of the shorter Newfoundland-Azores route to be taken by the seaplanes.

One novel feature of the radio installation of the C-5 is the aerial, which is stretched within the large gas bag. The transmitter is said to have a range of 150 miles while the receiving range is many times that. In addition, radio wires are strung from the stern of the boat to the rudder tail, these wires being probably intended as a capacity ground. The radio installation also includes a radio telephone, which can be used for telephoning to nearby destroyers and other ships.

The electrical installation of the C-5 includes all the lights necessary for night flying. Thus there are sufficient lights in the body to furnish ample illumination for the crew, while navigational lights are provided in true ship style. There are the usual red and green running lights, as well as a red tail light. In addition, the ship carries a six-inch Aldis searchlight for signaling to ships on the water and other aircraft.

Use of Molybdenum in Making Steel

FERROMOLYBDENUM is added to steel as a fixed addition, nearly all the molybdenum remaining in the steel, according to a prominent American metallurgist. It is supposed to give the steel properties similar to those of tungsten steel, but only one-third to one-half as much molybdenum is necessary; that is, where regular high-speed steel contains 18 per cent tungsten, 6 to 9 per cent of molybdenum may be substituted. However, it gives these properties only when the addition is properly made and proper heat treatment follows. The regulation of these factors caused so much trouble and expense that, in the United States, the manufacture of molybdenum high-speed tool steels has been practically discontinued for several years. It is used for this purpose in other countries, however, to a considerable extent. At the present time it is mainly employed in tool steel as an auxiliary rather than as a major constituent. Various reasons have been assigned for the discontinuance of the use of molybdenum. Taylor found that molybdenum in rapid steel caused irregular performance; that steels of the same composition, and having had seemingly the same treatment, gave large variations in their maximum cutting speeds. One manufacturer has stated that the ingots crack in forging, the tools crack on quenching and molybdenum appears to volatilize from the steel when heated.

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RAYMOND ROBINS'
Sensational Story of
BOLSHEVIST RUSSIA
begins in the Metropolitan

"I shall adopt the spirit of what you say, in something I am writing as to the lesson of Russia for us. There isn't anybody in this country I am so anxious to see and to hear at length exactly along the lines you speak of as you."—THEODORE ROOSEVELT
in a letter to Raymond Robins in September, 1918

RAYMOND ROBINS

BOLSHEVISM is a fact. It has overspread Russia like a torrent and is sweeping Eastern Europe. The days of ignoring it; of just calling it hard names are past. Now we must face it, recognize it, understand it.

The American who knows Bolshevism, who dealt with Bolshevists daily, who has rubbed shoulders with the thing that is sending the world into spasms of terror, has consented to tell the story of Bolshevist Russia to the American people through the pages of the Metropolitan Magazine.

Raymond Robins went to Russia for the Red Cross in the early days of Kerensky. His appointment was the result of Colonel Roosevelt's earnest plea. Roosevelt knew his man.

Robins' job was to feed starving women, and children. When Kerensky fell and Lenin and Trotsky rode into power it was still Robins' job to feed those who hungered. It was no time for quibbling or for politics. It was time for bread.

Robins went to Lenin and Trotsky. He demanded a free field and no interference. Would they trust him? They did and Robins became the unofficial American representative to the Bolshevist group.

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Raymond Robins' story of Bolshevist Russia, as told to William Hard, begins in the June Metropolitan and will run for six issues.

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NEW BOOKS, ETC.

THE GEOGRAPHY OF EUROPE. Edited by Ellsworth Huntington and Herbert E. Gregory. New Haven: Yale University Press, 1918. 8vo.; 96 pp.

Prepared under the auspices of the Division of Geology and Geography, National Research Council, this text, which it is intended to elaborate later, presents some aspects of European geography for the use of members of the Students Army Training Corps. A group of men in active government service have collaborated to supply the existing deficiency in the quantity and quality of available instruction, and their articles on physical, social, industrial and international relations form a promising nucleus for the projected work. A short but well-selected bibliography is appended.

INTRODUCTION TO ORGANIC CHEMISTRY. By John Tappan Stoddard, Professor of Chemistry in Smith College. Philadelphia: P. Blakiston's Son and Company, 1918. 12mo.; 423 pp.; illustrated.

This is a very good text for use in connection with the lectures, recitations and laboratory work of a college first course. The student should leave its direct teachings with clear ideas as to the principles of organic chemistry and its relations to general chemistry, and of the part played by the former in our everyday life and industry. This second edition reconstructs the sections on the natural oils and fats, on uric acid and the purine bases, and on the proteins, and in other ways improves upon the original edition.

THE "WELCOME" PHOTOGRAPHIC EXPOSURE RECORD AND DIARY. 1919. New York: Burroughs Wellcome and Co. 256 pp. Illustrated.

This flap-cover pocket book combines in compact and attractive form much practical information, receipts and tables, blank sections properly ruled for records of negative exposures, diary entries, and memoranda, and a movable-disk exposure calculator. The last has proved of the greatest convenience to photographers the world over, and this year it adds an improvement by which it is made to tell the correct exposure for every stop at a glance, by the use of a single revolving scale.

THE SHIPBUILDING INDUSTRY. By Roy Willmarth Kelly and Frederick J. Allen. Introduction by Charles M. Schwab. New York and Boston: Houghton Mifflin Company, 1918. 8vo.; 303 pp.; illustrated.

It was a question of building ships faster than the U-boats could sink them—and we did it. How we did it is told in the official and authoritative book, written with the assistance of the shipping board. It shows a vast, highly intricate industry developing with magical rapidity from a mere nucleus. More than a hundred sharp photographic reproductions depict the parts played by the various trades in the step-by-step production of a ship: there are views of yards and shops and vessels and launchings. The descriptions, interesting to the general reader, will be helpful to those who are looking to naval architecture or executive positions as vocations, and will forward the understanding and advancement of the routine worker. Every activity, from the making of the blue-print to the launching of the vessel, is made plain by qualified teachers.

STANDARD MANUAL OF THE INCOME TAX. 1919. New York: Standard Statistics Company, Inc. 8vo.; 1374 pp.

This excellent exposition offers definite aid on every point the taxpayer needs explained, and in such manner that he can turn at once to the explanation without wading through a mass of inapplicable material. It first familiarizes him with the Act by means of a careful digest: this alone answers many of the less involved questions that arise. The full text of the Act follows, after which comes a general index. The second section of the work cites the market prices of over 10,000 securities of March 1st, 1913, gives official decisions and other valuable data, and furnishes a complete list of collection districts. Typical problems solved are the determination of "invested capital," the computation of the net taxable income and of surtax, the interpretation of "tax-free bonds," stock dividends, and the allowable deduction of certain taxes. Hundreds of snarls are untangled, many of them by letters from the Commissioner of Internal Revenue. Numerous questions from taxpayers are fully answered, and a separate supplement is a part of the service rendered.

APPLIED MECHANICS. Vol. II. Strength of Materials. By Charles E. Fuller, S.B. and William A. Johnston, S.B. New York: John Wiley and Sons, 1919. 8vo.; 556 pp.; illustrated.

Engineering students who come to this work with a knowledge of calculus, statics and dynamics, centers of gravity and moments of inertia will find it a very thorough exposition of such fundamentals as may be required in structural and machine design and engineering practice. It develops all considerations logically and soundly and never fails to discriminate between the ideal conditions upon which theoretical formulas are based, and the conditions accompanying actual problems. Graphical methods, both of solution and of the representation of results, are freely employed, and the theories presented are embodied in a generous assortment of problems. The text was primarily designed for students in the Departments of Engineering in the Massachusetts Institute of Technology.

STUDIES IN ELECTRO-PHYSIOLOGY. (Animal and Vegetable.) By Arthur E. Baines. New York: E. P. Dutton and Co., 1918. 8vo.; 291 pp.; illustrated.

These researches present a new view of the operating forces of the living organism, and date from the author's discovery, while cable-testing in Delagoa Bay, that the electrical currents of his own body disturbed the readings of the galvanometer. The work records some most interesting experiments in support of the electrical structure and function of plant life, and proceeds to electro-physiology, the nature of the nerve impulse, cell reproduction, unipolar and bipolar cells, the organs of sense, etc., with an interpretation of electrophysiological phenomena. It is a provocative work that seems likely to open the door to a new and fruitful conception of the part played by electricity in the human economy.

THE BRITISH NAVY IN BATTLE. By Arthur H. Pollen. Garden City, N. Y.: Doubleday, Page and Company, 1919. 8vo.; 358 pp.; illustrated.

Whitehall had blundered. With a navy whose every tradition goaded it to offensive action, Whitehall long insisted upon "timorous—because unimaginative and ignorant—caution." In this work by England's great naval expert the results of this policy and its reversal are shown in masterly studies of the encounters between German and British units and fleets. Fallacies are exposed, root doctrines expounded, and the elements of victory re-stated, all so plainly that the general reader is never bewildered. Every important action is exhaustively analyzed, yet these analyses are tense with the spirit of adventure. It is a work every American should read, for its lessons cannot be too universally pondered.

MY LIFE. By Sir Hiram S. Maxim. London: Methuen and Co., Ltd. 8vo.; 322 pp.; illustrated.

In this large, clearly-printed work, the Maine-born celebrity whose name is so closely identified with the automatic gun tells the story of his crowded life. It is a simple, direct, almost naïve account, full of conversation and anecdote. The author takes a boyish pride in his own achievements, and this adds rather than detracts from the interest of the volume. His first invention was an automatic mouse trap; he was something of a prize fighter, had a week as a bartender, vanquished an obstreperous bull with bare hands, and invented gas machines, steam traps, locomotive headlights, and the electric regulator that won him the decoration of the *Legion d'Honneur*. Many of his inventions are shown in the illustrations, including the automatic gun in various stages. His flying machine experiments are recounted, his success with smokeless powder, and many other achievements. It is the interesting and not infrequently amusing autobiography of a chronic inventor.

THE STARRETT DATA BOOK FOR MACHINISTS. Vol. II of the Starrett Books. Athol, Mass.: The L. S. Starrett Company, 1918. 12mo.; 179 pp.; illustrated.

This presentation of shop practice and the materials of manufacture is almost entirely in tabular form. Familiarity with machines and tools is taken for granted: it thus supplements Vol. I, which dealt with the how and why of operations and procedures. As a work of reference, the concise form of treatment makes it possible to pack into small space a great amount of useful information.

STUDIES IN ELECTRO-PATHOLOGY. By A. White Robertson, L.R.C.P. and S.E. New York: E. P. Dutton and Co.; 1918. 8vo.; 304 pp.; illustrated.

The author traces disease to a disturbance of equilibrium in the chemical and electrical activities of the cell, and examines such curative mediums as promise a restoration of normal conditions. Among other suggestive discussions are those on the physiological action of light, electrical phenomena in metabolism, dielectric tissues, and electrical tensions. In the section on wound treatment many specific cases are cited where dielectric treatment alone produced excellent results. The last part of the volume is concerned with electro-pathology; it discusses toxins and master-toxins, and has significant papers on beri-beri and pneumonia.

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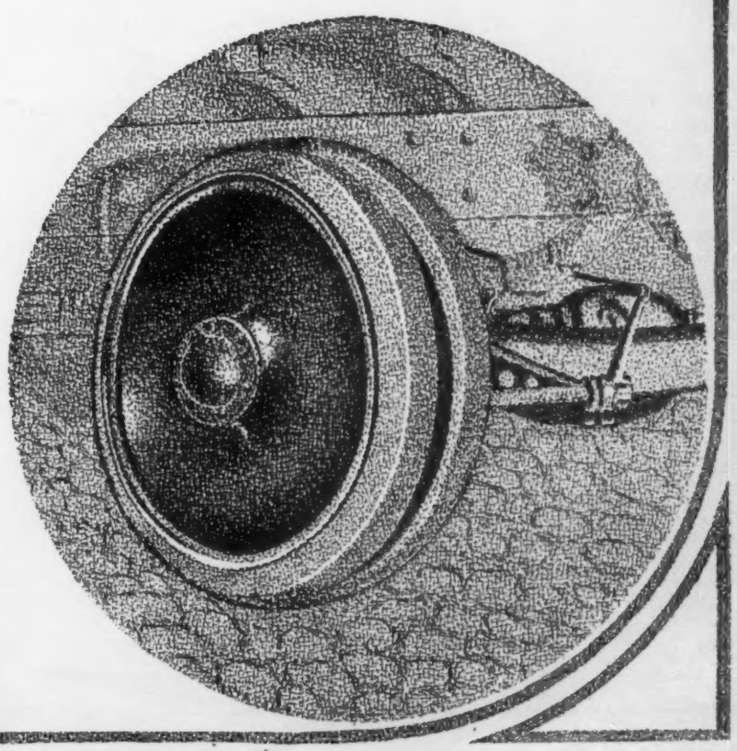

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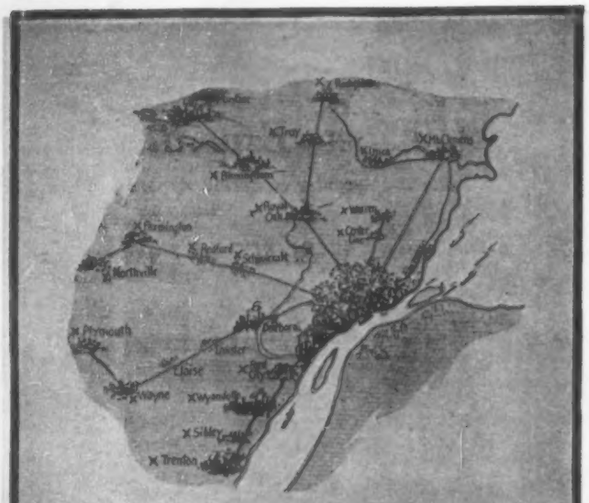

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